DOCUMENT RESUME

ED 215 032 UD 022 181

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TITLE A Summer Enrichment and Reinforcement Program in the School of Veterinary Medicine at Tuskegee Institute, Alabama. A Program Designed to Respond to a Challenge: Increased Minority and Disadvantaged Representation in Veterinary Medicine.
INSTITUTION Tuskegee Inst., AL. School of Veterinary Medicine.
SPONS AGENCY Health Resources Administration (DHEW/PHS), Bethesda, Md.
PUB DATE 80
NOTE 60p.; Not available in paper copy due to institution's restrictions.

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Academic Achievement; *Compensatory Education; Educationally Disadvantaged; Higher Education; *High Risk Students; *Improvement Programs; Program Evaluation; Summer Programs; *Teaching Methods; *Veterinary Medical Education
IDENTIFIERS *Tuskegee Institute AL

ABSTRACT

This report describes a pre-entry summer program at the School of Veterinary Medicine at Tuskegee Institute, Alabama, designed to develop attitudinal readiness and cognitive abilities of students who face a high risk of attrition because of inadequate learning skills. The program, which runs for eight weeks, consists of three phases: 1) phase one, in which students are instructed in medical terminology skills, organizational skills, and test-taking skills to facilitate comprehension in veterinary medical courses; 2) phase two, in which students are helped to develop the critical thinking skills essential to scientific thought; and 3) phase three, which is devoted to program evaluation through assessment of student performance on achievement tests. The report discusses different aspects of each of the program phases in detail, including theory, activities, and the results of past experience in implementing the program. The program syllabus and data on the performance of trainees in past programs are appended to the report. (MJL)

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A SUMMER ENRICHMENT AND REINFORCEMENT PROGRAM IN THE SCHOOL OF VETERINARY MEDICINE

AT

TUSKEGEE INSTITUTE, ALABAMA

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A program designed to respond to a challenge: Increased minority and disadvantaged representation in Veterinary Medicine

SP 022 181

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This publication is made possible by a grant from the Health Careers Opportunity Program, Health Resources Administration, Department of Health, Education and Welfare.

ACKNOWLEDGMENTS

We are especially grateful to the persons named below for their valuable contributions to the Summer Enrichment Program and the realization of this manual.

Special thanks are extended to Mrs. Ethel Cyrus, Mrs. Betty Henderson, Mrs. Carolyn Ford, Dr. W. E. Johnson, and Dr. J. E. Webster for their assistance to the trainees in and out of the classroom. These persons help our trainees in the Survival Skills, library, and audiovisual/autotutorial and Computer-Based Education laboratories.

The following members of the veterinary faculty spend long summer hours teaching in the basic science section.

Dr. A. W. Dade
Dr. G. A. Chibuzo
Dr. E. M. Hall
Dr. G. E. Heath
Dr. K. Lam
Dr. C. L. Padmore
Dr. R. L. Judkins
Dr. O. P. Verma
Dr. J. E. Webster
Dr. B. B. Watson
Dr. R. C. Williams
Dr. T. S. Williams

We extend special gratitude to Mr. Roger Hagerty, staff photographer; Mr. John Phillips, video tape cameraman and editor; Ms. Christine Love and Mrs. Laurice Tolliver for their unending patience in typing several drafts of the manuscript; Mr. Lawrence Rabon for his audiovisual assistance and Mrs. Brenda Flanagan for her valuable journalistic contributions.

E. W. Adams, Program Director

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This publication is made possible by a grant from the Health Careers Opportunity Program, Health Resources Administration, Department of Health, Education and Welfare.

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PREFACE

The Tuskegee Institute School of Veterinary Medicine was created in 1944 to provide educational opportunities in veterinary medicine to an educationally disadvantaged minority group for whom this opportunity had been denied. In the fall of 1945, thirteen black students entered the program as first-year students. At that time, the curriculum covered only the basic science courses, with the remaining two professional years yet to evolve. Since this beginning, the school has grown in enrollment, racial diversity of its faculty and student population, faculty size and level of formal education, number and variety of curriculum offerings (undergraduate and graduate), research capabilities, and adequacy of physical plant.

During this period of more than three decades, the School of Veterinary Medicine has played a significant role in the development of black veterinarians. As the only one of 27 schools of veterinary medicine in the country located at a predominantly black college, it is in a unique position to help resolve the manpower shortage in veterinary medicine and related health careers through the development of students from academically disadvantaged minority groups. Eighty percent of the black veterinarians in this country are graduates of the Tuskegee Institute School of Veterinary Medicine.

Our efforts to provide an educational opportunity for seriously academically disadvantaged minorities have not lessened our commitment to graduating professionally competent veterinarians. We have sustained a high rate of attrition among students who encountered severe difficulties, particularly during the two basic science years of the medical curriculum. Of the 13 students in the first class (1949), only five (46 percent) survived the first two years and completed the professional program. The attrition rate over the years continued to be high — averaging 35.6 percent during 1949 through 1970. On the other hand, in spite of the high attrition rate, those who survived to graduate each of these years attained class averages on the United States Department of Agriculture's Accreditation Examination at or above the 80th percentile. In addition, during this period, a high percentage of our graduates passed State and National Veterinary Examining Boards and entered veterinary practice. The result of a comparison of a high attrition rate for our academically disadvantaged students with the subsequent high performance of the survivors on the National and State Board Examinations led to the concern of this faculty to develop ways and means of increasing the number of students who progress satisfactorily through the program.

In the spring of 1970, the faculty developed a curriculum reform proposal which incorporated its deep concern for increasing the retention and graduation of minority enrollees, and for broadening and improving its curriculum offerings in line with demands of emerging health careers in veterinary medicine.

Under a Bureau of Health Manpower Health Career Special Project grant, the 1970 curriculum reform program was initiated. The design consisted of four reinforcement components: (1) a pre-entry reading program; (2) a lecture syllabus; (3) a multi-media self-learning resource; and (4) a tutorial program.

Since 1971, many innovations and refinements have been made within each of the four reinforcement components. These developments have resulted in significant reduction of the high attrition rate among students during the years of curriculum reform. In contrast to the high attrition rate of 1949 through 1970, our rates during five curriculum reform years have ranged from 10.6 percent to 8.8 percent.

Through the dedicated efforts of a concerned faculty, the four reinforcement components have developed into effective instructional means for supporting, developing, and graduating interested, potentially capable minority recruits for employment in veterinary medical careers.

The most dramatic changes among the four reinforcement components have been in the pre-entry summer program.

A SUMMER ENRICHMENT AND REINFORCEMENT PROGRAM IN THE SCHOOL OF VETERINARY MEDICINE

AT

TUSKEGEE INSTITUTE, ALABAMA

I. INTRODUCTION

The Tuskegee Institute's School of Veterinary Medicine pre-entry summer program was initially a reading program. Throughout the years preceding curriculum reform, our high attrition rate had been associated with the low reading scores of students entering the program. Based on the problems implied in these scores, emphasis of several summer programs was in the development of selected basic reading skills: vocabulary, paragraph comprehension, and increased reading speed.

During the summer of 1974, it became evident that this approach was poorly conceived. Its emphasis was unnecessarily elementary; and it failed to utilize the chronological maturity, high motivation, and scientific backgrounds of the trainees whom we serve. It also failed to relate to the types of problem-solving study skills that these trainees would need if they were admitted into the veterinary medical curriculum

In 1975, we made a deliberate effort to design a pre-entry program more relevant to typical inadequacies in learning skills. We hoped, also, to remedy the fragmentation of scientific information that results from undeveloped systems of comprehension and analysis. The new design is a coordinated, two-faceted program which places emphasis on (1) the reinforcement and enrichment of integrated scientific data, and (2) the development of thinking/study systems that undergird medical problem-solving. The new design has proved to be more challenging, more relevant to the demands of the curriculum, and more self-continuing as lifelong systems of learning.

In addition, the pre-entry summer program has provided insights and strategies which have been instrumental in strengthening the designs of the other three reinforcement components of the original reform proposal: syllabi, autotutorial media laboratory, and peer tutorials. In fact, the tutorial program has become an extension of the summer program in rationale, objectives, and approaches to student needs.

Because of the effectiveness of the summer program in developing survival skills and content background of high risk trainees, and in revealing approaches which are adaptable to learning problems of other students throughout the program, the entire following report is devoted to an analysis of the pre-entry program design. This design is the result of the experimental efforts made in the summers of the curriculum reform years to develop a short-cut educational solution for the types of academic deficiences that undermine the survival of the high risk students whom we serve.

II. PROGRAM PERSPECTIVE

In his book, **Teachers and Learners**, Alfred H. Gorman states:

> *Actually, any teaching, call it traditional, progressive, or any other name, seeks to create a readiness and an ability to learn. Teaching without the creation of these conditions is similar to a book in the hand of an illiterate.*[1]

In our summer program, we subscribe to Alfred Gorman's philosophy. We try to develop in trainees the attitudinal readiness and cognitive abilities that are essential to effective learning.

The eight-week summer program is divided into three time periods. The first period lasts one week, the second for six weeks, and the third for one week. In period one, we seek "to create a readiness" in our students. The summer program is explained to the trainees. The trainees learn what to expect as well as what is expected of them. They are helped to understand the problems that have inhibited their learning and what they can do during the summer to eliminate those problems.

The second period is devoted to an instructional program which is designed to help trainees move from their initial baselines in each cognitive skill to a degree of mastery adequate for survival in the first year of the veterinary school curriculum.

Our experiences support our firm belief that for high risk students, initial baselines are deceptive as measures of learning potential and should be viewed as merely indicative of a tentative learning status. However, we find preassessment vital to effective learning effort when it is used to indicate needs and set priorities. Well-designed instruction, appropriated

to initial needs, often releases powers that defy predictability of learning success.

We have developed a two-faceted program to facilitate the development of trainees in their basic learning-to-learn abilities and their medical science aptitude needs. The first phase is used to instruct students in the three major skills they will need to facilitate their comprehension in veterinary courses. These major skills are: (1) medical terminology skills, (2) organizational skills, and (3) test-taking skills.

Part two of this two-faceted program is the integrated science enrichment phase. This is designed to help trainees develop the three important critical thinking skills that are the major components of scientific thought: (1) the conceptualization process by which factual information is generalized to derive a broad understanding that is adaptable to various kinds and levels of problem-solving; (2) the judgmental process with which trainees determine the validity, reliability, or appropriateness of information in relation to problems to which it will be applied; and (3) the problem-solving process of transferring and adapting pertinent information to the medical problems to be resolved.

The science enrichment staff emphasizes these three ways of critical thinking in a unit on the scientific method of problem-solving, and a unit on the interdisciplinary conceptualization of the cell.

During this second period of the program, trainees are encouraged to use the library and the learning resources center to develop their abilities. The library and the autotutorial laboratory are key elements in our summer program in the development of self-continuing attitudes and abilities.

The administrators of the summer program work conscientiously to achieve coordination among the staffs of the instructional units. Integration of the survival skills and science enrichment phases takes place when the trainees, in practice exercises, must utilize the information they have developed. They take notes, systematically organize information, raise questions for both general and analytical comprehension purposes, and solve questions and problems raised by lecturers or the trainees themselves.

Concurrently, the science enrichment staff involves the basic skills of medical terminology, organization for integrative purposes, and formative test-taking in planning and executing their instructional sequences.

The third time period of one week (the eighth week) is devoted to five types of program evaluation: (1) post-assessment of all preassessed functions; (2) a computation of progress scores; (3) an evaluation of the program by trainees; (4) a summary by the staff of impressions relative to the success of the combined efforts of staff and trainees in meeting the challenges set forth in the initial orientation lecture series; and (5) a pooled compilation of recommendations for making future summer programs better fulfill the objectives of the program in the limited time available.

In the following pages of this section, we will detail the activities of each of the scheduled periods of our summer program.

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[1]Alfred H. Gorman, **Teachers and Learners: The Interactive Process of Education**, 2nd ed. (Boston: Allyn and Bacon, Inc., 1974), p. 159.

III. ORIENTATION WEEK

A. Orientation Lecture Series

Three lectures are presented during the first week of the program.

LECTURE 1

The first lecture is designed to provide trainees a broad perspective of the veterinary medical profession. In a brief historical review, the lecturer stresses progressive changes in purposes, scope of services, required professional standards, various new opportunities for specialized education and employment, and the professional respectability which has come with the recognized importance of veterinary medicine in the improvement of human and environmental health conditions.

Next, he emphasizes the importance, scope, and sequence of the four-year veterinary curriculum of Tuskegee Institute in producing a scientific, problem-solving veterinary practitioner and researcher.

Following this curriculum perspective of major interrelated content and

skill components, the lecturer gives an overview of the summer program. In this overview, he introduces those requisite aptitudes for success in the curriculum that are included in the professional instrument known as the Veterinary Aptitude Test (VAT). The five functions included in this instrument are presented as concerns of the summer program, and as the basis for the two-faceted summer program design that focuses on the integrated enrichment of the basic medical science contents, and the development of the major cognitive skills essential in the utilization of this content in medical problem-solving. At this point, each trainee is given a program syllabus in which the concerns of the various facets are stated and the instructional plans are outlined. A copy of the syllabus is included in appendix 1.

The first orientation lecture ends with a challenge to trainees to utilize fully (1) the learning-to-learn survival skills facet designed to remediate any deficiencies they may bring to the program in basic approaches to the processes of organization and analysis of terms, facts, and factual generalizations; and (2) the critical thinking processes of the integrated science enrichment facet that constitute the scientific steps in clinical problem-solving.

LECTURE 2

Each summer we include in our orientation a lecture on the noncognitive requisites for success in the four-year program. Often, educationally disadvantages students have accepted defeat in their learning efforts. As a result, their cognitive failures are compounded by noncognitive problems that express themselves in the loss of confidence, hope, and disciplined effort. The major purpose of our second lecture is to emphasize the importance of the personal assets of self-understanding, self-responsibility, and persistent self-discipline. The case analysis approach used in this lecture is convincing evidence that noncognitive characteristics are sometimes the most decisive factors in a student's success in the program, despite the inadequacies of his initial cognitive powers; and of another student's failure to survive in the program despite his initial strength in cognitive areas.

The challenge of these cases is to assist students in the development of positive attitudes and dedicated efforts needed to meet the rigors of the veterinary medical curriculum.

LECTURE 3

The last lecture of the series focuses more specifically on the clinical importance of the information trainees bring to the program, and of the first-year courses they will study.

The lecture assures trainees of the importance of information already in their scientific data bank as a useful background for the information they will continually add in their study of anatomy. Through a carefully selected set of 2 x 2 slides, trainees are led to see the importance of a knowledge of anatomy in clinical medicine and the crucial importance to a medical student of constantly projecting anatomical information to its meaning in relation to its clinical usefulness.

In the course of the lecture, trainees discover the importance of perceptual learning at this early stage of their education. Observation is emphasized as an important learning avenue. Slide examples (2 x 2 color) of animals whose normal and/or abnormal conditions are observable and identifiable without the use of hands or historical records are convincing evidence to the trainee of the importance of both their apperceptive and perceptive resources in approaching the clinically oriented first year of the veterinary medical curriculum.

B. Preassessment Profiles

The purpose of pre-assessment is to determine the initial level of development that each participant brings to the program. As stated earlier, the objectives of the pre-entry summer program include five abilities which are essential aptitudes for success in the study of veterinary medicine. The VAT is an instrument designed to appraise these five abilities.

The VAT screens trainees' abilities in five important concerns of the summer program: two skills (general reading facility and study reading) and

three basic medical sciences areas (quantitative, biological, and chemical). The nature of the aptitudes that the instrument attempts to assess is clearly stated in the accompanying test literature: the quantitative test is a measure of ability to reason through and understand quantitative concepts and relationships; the biological test is a survey of principles and concepts from college-level biological courses; the chemical test is a sampling of concepts and problems from elementary college chemistry, including organic and inorganic chemistry.

These descriptions indicate that the VAT is a sensitive instrument for assessing trainees in the abilities that our two-unit science enrichment facet is designed to strengthen. Even the general reading and study reading tests utilize medical science information.

In addition to these five abilities, our instructional design includes three basic learning-to-learn skill processes which often are not adequately developed in educationally disadvantaged trainees whom we serve: (1) the skills of vocabulatory development, (2) organization of information, and (3) test-taking. Standardized test instruments are utilized in screening the ability of trainees in each of these skills.

The five tests of the VAT and the three survival skills tests provide norms which are useful to trainees as indicators of their initial learning status in relation to national standards. In the 100-item vocabulatory test, percentage scores are used as a substitute for percentiles.

Our pre-assessment of trainees has developed into an important phase of our summer program. We suggested earlier the attitudinal importance of trainees' cognitive self-understanding. Our trainees are motivated by self-understanding that is definitive enough to indicate relative strengths and weaknesses. These scores also provide for each function assessed, an initial, tentative baseline from which trainees can move in measurable steps provided in each facet through formative tests built into instructional sequences.

In addition to these eight objective tests, each trainee is required to write a self-evaluative narrative in which he responds to items designed to reveal non-cognitive characteristics which may affect his learning development. These narratives are a valuable phase of our pre-assessment program.

Following the scoring of the objective tests, we develop scales for each ability appraised. The scales range from the highest percentile score to the lowest among the group of trainees. These scales provide a quick picture of the spread of the group on the national percentile scale. The top score represents the percentile reached by the highest performer among trainees. This highest score may or may not represent an average (50 percentile) level of achievement, even though it represents the highest class performance. Trainees are told about the variables which are involved in the interpretation of their individual profiles.

In addition to seeing their learning status in relation to national and peer standards, trainees see in their profiles their greatest and lowest developments, which constitute their uniqueness in relation to important aptitudes. From these irregularities, trainees set priorities in their use of autotutorial media available for their use during unscheduled hours.

Figure 1 (page 5) shows profiles of three trainees on tests included in pre-assessments for the survival skills and science enrichment facets.

An analysis of the scales for the three survival skills reveals significant differences among trainees in terms of range of scores, class ceilings, the numbers of those who fall below the medial scores (50 percentile), and the relative strengths of class and individuals among the three skill processes.

In the organizational skill, trainees range in performance from 90 to 15 on national norms; in analysis, from 95 to -3; and in vocabulary, from 81 to 20 (percentage scores). In organization, 4 out of 18 are below the 50 percentile; in analysis, 12 out of 17; and in structural analysis, 7 out of 18.

These scales become useful, also, in reflecting relative strengths and weaknesses of trainees when their scores are profiled to show their position on the scale, skill by skill. The trainee

PRE-ASSESSMENT SCORES ON THE THREE BASIC SKILLS OF THE SURVIVAL SKILLS FACET

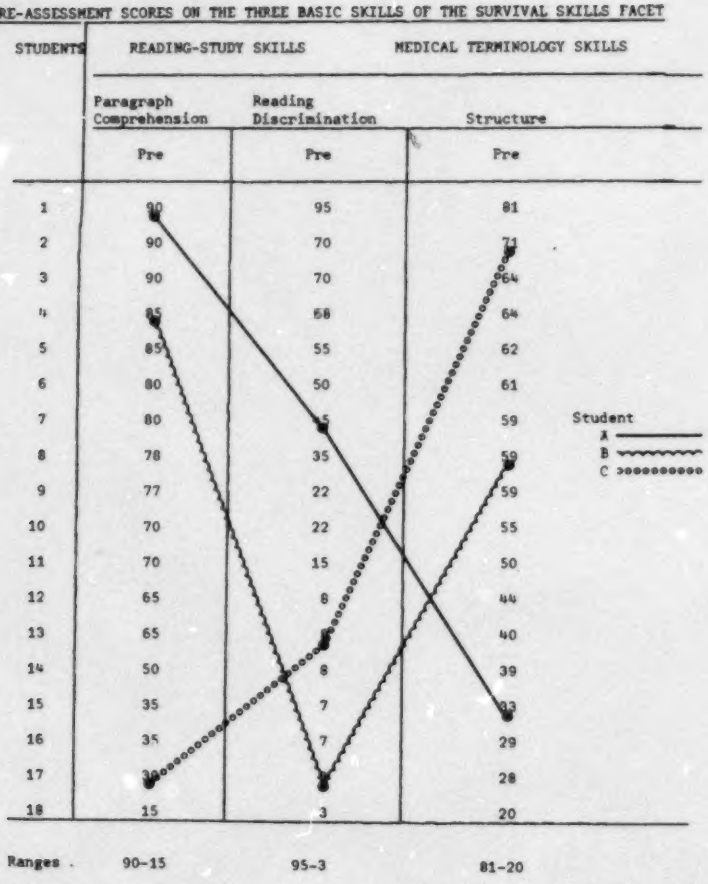


Figure 1

discovers that he may be in the top quarter of the class in one test and in the bottom quarter of the class in another. This discovery is reassuring in that he sees himself as having relative inner strength and also strength within his peer group.

The VAT profiles (Figure 2 page 6) are based on the same principles of scaled class percentile scores and individual profiles indicating performances in relation to national norms, class ranges, and individual irregularities of strengths and weaknesses among the five separate aptitudes.

An analysis of the various scales indicates that no trainee is at the 50 percentile in his quantitative ability, and that 11 out of 18 fall at the 01 and 02 percentile level. In the biological test, the range reflects a higher ceiling for the group: 95 percentile, and fewer (6 out of 18) are at the 01 or 02 percentile level. In the chemistry test, the range is shorter; the top score is at the 35th percentile level, and 11 out of 18 are at the 01 or 02 percentile point.

In the two skill tests, reading facility is generally less well developed than the study skills of organization and analysis of scientific information.

The last scale is a combined score. This score is used in the profession as a more significant single measure of aptitude for success in the program than the score on any one of the five separate aptitudes. Among the 18 trainees, the highest combined score is at the 35 percentile level. Of the 18 trainees, 11 are at the 01 or 02 level.

As these profiles are interpreted as tentative baselines on the important cognitive abilities which the summer program is designed to develop, we encourage trainees to assume active responsibility for their fullest develop-

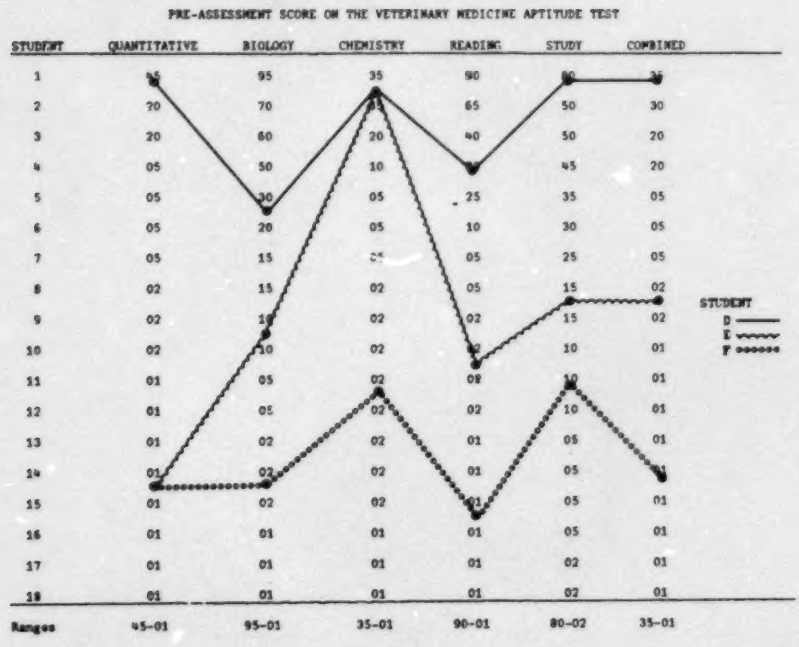


Figure 2

ment through instructional and auto-instructional provisions.

We emphasize the fact that strength in one ability does not guarantee or necessarily facilitate the development of strength in other skills. Consequently, trainees need to exert efforts to improve their proficiency in all of the eight concerns of the summer program.

The challenge of the summer program is implied in these data, for in the final analysis, the success of our program will be determined by the degree to which our various instructions are an effective intervention between initial baselines and the achievement of content and process developmental levels that are adequate for survival in the professional curriculum.

IV. SURVIVAL SKILLS

A. Medical Vocabulary Skills

A student who brings to his professional education only a large number of scientific definitions and rote memory as the sole approach to the understanding of new scientific terms that are encountered, will find the demands of the first year in veterinary medicine insurmountable. Readiness for the academic program requires the development of a cognitive approach to coping with terminology problems.

Basically, scientific terms are the avenues by which the student will derive the meaning of scientific facts. As these facts accumulate, the terms become symbols of an increasing load of meaning. In fact, a medical vocabulary represents both the quantity and quality of an ever-growing scientific data bank. It is therefore crucial that sytematic approaches to an adequate medical vocabulary be included among the basic learning-to-learn skills that undergird survival in the veterinary medical curriculum.

Three dynamic skills constitute effective approaches to the meaning of the numerous medical terms that participants will need to know.

1. Structural analysis;
2. Use of contextual clues; and
3. Conceptualization of terms through synonyms, antonyms, and analogies.

Structural analysis is a process which utilizes the meaning of medical

word parts (prefixes, roots, and suffixes) in deriving the meanings of unfamiliar words, and in constructing new words to express rapidly developing scientific concepts. Through this skill, participants develop facility in coping with new words constructed from familiar word parts in a variety of combinations. They begin to see that, generally, new constructs are just different combinations of parts that are elements in words already known to them. They discover the process of fusing the meanings of these elements into the synthesized definition of the previously unknown scientific terms.

Learning activities in structural analysis involve students in processes of both organization and analysis, which are the two major survival skils that are concurrently emphasized in a period of the scheduled morning sessions.

As participants develop facility in the use of structural analysis in attacking the meanings of medical terms, they begin to discover the diverse potential of every medical term in different contexts. Here a participant confronts the fluidity of a term in relation to the substance, style, or purpose of a particular context. He needs practice in discerning that the same term may subtly communicate different aspects of meaning in particular science disciplines or in specific courses within a science discipline. Practice exercises in the use of contextual clues, therefore, are designed to provide experiences that develop readiness and mobility of responsiveness to the problem nature of terms. This is done within the contexts that constitute major clues to different shades of meaning that a term may connote.

At the point of initial mastery, participants begin to use the two approaches in combinations appropriate to the nature of the terminology situation. These planned cumulative exercises are vital in moving participants from limitations inherent in a one-track approach to a system that encompasses other approaches.

Fragmentary learning is one of the most common weaknesses among educationally disadvantaged students. Conceptualization as a remedial measure became a new emphasis for the 1979 summer program. The skill of conceptualization was introduced and made a common objective of each facet of the instructional design.

Unlike structural and contextual approaches which focus participants on the meanings of single words, the conceptual approach focuses them on the meanings of terms in relation to other terms. Trainees may then comprehend and interpret an unknown term through seeing how it relates to a known word that bears a characteristic similarity. This technique not only unifies the terms in a way that broadens the bounds of meaning of each but, in time, leads participants to discover that among similar or synonymous terms are subtle differences in what these terms connote as symbols of scientific information.

In the same way, relating new medical terms to known terms that communicate opposite meanings serves both the purpose of broadening and refining each term. Participants learn to construct positively and negatively related terms by manipulating movable structural elements.

Formative test items provide reinforcement of word meanings, and exercise participants in judgment of the interrelationships that these terms bear to each other. The matching test mode provides an opportunity for pairing words that bear synonymous or antonymous relationship with other terms. True-false items provide exercises in the judgment of a stated relationship that may or may not be correct. Both positive (synonymous) and negative (antonymous) relationships among numerous medical terms extend a term's meaning beyond its mere definition.

A third basic conceptual vocabulary skill is analogy. Students use a known relationship between members of one pair of terms as a criterion of judgment of similar or dissimilar relationship between the members of a second pair. Simply stated, the formula is: one is to two in a similar way as three is to four or 1:2::3:4. Identifying the nature of the relationship between one and two in the equation is crucial to establishing or judging a similar relationship between three and four. Analogies constitute a critical

processing strategy in the conceptualization of scientific information.

Multiple choice items are effective formative exercises in the identification of the pattern of relationship which must exist between terms in both pairs being compared. The relationship pattern in one side of the equation becomes the problem clue in the judgment of the validity of the relationship pattern in the other side of the equation. The multiple choice options from which participants choose reinforce comprehensive organization, critical interpretation, and judgment in a conceptual integration of numerous facts. Discussion of participants' performance on the multiple choice analogy exercises serves to clarify this important skill process. Participants are instructed in all three of the subskills of the medical terminology unit through a programmed text.[2] Performances on this pretest are evaluated, and individual baselines are noted. These evaluations indicate to participants the terminology problems which the ten units of the programmed text are designed to solve. Assignments are scheduled to progress participants through the self-instructional sequences and built-in problem-solving exercises. These exercises involve structural analysis and synthesis and the use of classification clues in such groupings as bodily systems, diseases of animals, symptoms of disease, and processes of medical treatment of pathological conditions.

The self-instructional programmed sequences are supplemented during a weekly session directed by a regular member of the faculty of the Department of Anatomy who brings to the session a sensitivity to those terminology problems that structural analysis alone cannot solve. Instruction in this session emphasizes factors outside the term itself which affect in subtle ways the shades of meaning that a term takes on during the study of medical sciences.

Participants are required to use terms in sentences for their peers to interpret through a combination of the clues they have studied. This use of terms in context (the participant's sentences) strengthens their awareness of the importance of functionalizing the meanings contained in a term in the normal give and take of class discussion. Responses of peers to each other's use of terms sharpen the insights of each participant in critical judgment of the appropriateness of the use of the term in relation to the meaning intended by the user. Participants respond enthusiastically to these weekly stretching sessions.

Concurrently with the survival skill exercises in vocabulary development, further reinforcements are provided in the integrated science enrichment facet. Participants encounter many new terms in each science unit. They are encouraged to develop an understanding of these terms in relation to unit contexts and unit purposes.

The library, too, provides a supplementary support to medical terminology development. Although participants are encouraged to develop self-dependence in systematically attacking the meanings of unfamiliar terms, they are also instructed in the availability and usefulness of the library tools for those terminology problems that elude efforts of solution through the approaches they have studied. Participants are instructed in the study purposes which medical dictionaries serve, and the value of using the dictionary as a ready study aid when it is needed for correct spelling, correct pronunciation, variant meanings of a term, and similar and dissimilar terms that are related to stated definitions. In addition, the dictionary definitions are a yardstick for determining the degree to which a participant's effort to derive the meaning of a term on his own is true to the basic meaning in the professional dictionary that is and will continue to be an authoritative reference.

B. Organizational Skills

The system of organizing information for comprehensive understanding is another learning-to-learn skill that we emphasize in the program. Without it, students become overwhelmed when they encounter large amounts of scientific information. They

[2] G. L. Smith and P. E. Davis. **Quick Medical Terminology — A Self-Teaching Guide** (New York: John Wiley, 1972)

soon discover that unsystematic approaches they may have used with some success in previous educational experiences are self-defeating in veterinary medical education. Instead, they must substitute approaches through which they will discover the structural and meaningful wholes of which factual details are merely contributing elements. The system of organization must, therefore, be isolated, and the subsystems which compose it must receive specific instruction and adequate reinforcement.

Mrs. Betty Henderson checks students in a survival skills lab session.

Three important strategies aid the comprehensive grasp of large amounts of information: (1) apperception, (2) perception, and (3) insightful use of the organizational clues within instructional materials.

1. Apperception

The utilization of prior knowledge in the comprehension of new information is a vital strategy in organization for comprehension. It clarifies, expands, and synthesizes new, accumulating information.

Trainees meet in the lounge to discuss the program and to help each other with assignments.

Even the most disadvantaged student brings to the program some useful previous learnings, both cognitive and noncognitive. Students must learn to utilize the prior accumulations that have relevance to the new information they will confront. This requires the development of a sensitivity to clues in lectures and assignments that recall meanings already in their backgrounds.

Students discover the value of apperception through appropriate instruction and varied practice exercises designed to draw on the diverse background resources that are their uniqueness as learners. Class sessions that permit a sampling and pooling of apperceptive links from various trainees provide enrichment of relevant background information.

Through apperception, useful information is not lost but fuses with new information to become an enlarged mass upon which ideas and concepts will continue to be added, reinforced, enriched, and integrated within the ever growing scientific data bank.

2. Perception

Disadvantaged students are often the victims of a one-track approach to knowledge. Their role as learners has been that of reading texts or of listening to lectures. As a result, their perceptual grasp of information is inadequate. A one-sensory avenue alone often leads to impressions that are surface, incomplete, warped, or erroneous. The multisensory approach to perceptual learning is recognized more and more as a basic principle of effective teaching and learning. Students who have not been instructed in the availability and use of various sensory avenues to comprehensive meaning, need experiences through which they will discover that various types of learning media add dimensions to their understanding. They discover, too, that different types of perceptual experiences contribute different aspects of meaning. Lectures, laboratory experiences, audiovisual media, demonstrations, hand contacts, give and take of discussions, all serve to

give breadth, depth, and coherence to the essential body of information which students must comprehend. With greater comprehension, there is greater retention.

Every phase of the summer program utilizes media and activities that involve participants in a variety of sensory avenues to perceptual learning in as many different forms as are appropriate to the learning purposes being served.

3. Skillful Use of Organizational Clues Within Subject Matter

All subject matter—oral and written—contains various organizational clues. Without knowledge of these clues and of how they may aid learning and retention, students become increasingly fragmented as they move through science courses weighted with numerous important details. They must be made sensitive to the author's indications of various structural wholes (whole books, whole units, whole chapters), through such devices as tables of contents, introductions, chapter titles, topical headings, summaries, and even broad questions before or after sections to be studied.

In our unit on organization, we emphasize the importance of the basic steps of organization as a cognitive system. The first procedural step is exploration. Trainees soon discover the value of initial perspective as a structural framework within which major parts of the whole begin to relate before attention is diverted to numerous factual details. Through class instruction and mediated demonstrations of organizing procedures, they learn the value of notetaking as a subskill of effective organization of subject matter. They are introduced to the practice of refining raw notes as an aid to noting and recording the major ideas stated or implied in title, topical heading, introduction, summary, or other devices in texts, or by voice emphasis, transitional words, pauses, or repetitions as organizational devices in oral presentations.

As students begin to show understanding and use of the exploratory or surveying approach to comprehension, they are encouraged to raise questions directed to the central ideas of a selection; to the major topics that support the central ideas; and to the nature of the relation of these major supportive ideas to both the central idea and each other. Emphasis is also placed on how these major supportive ideas grow out of and move back into the central idea. Actually, surveying and general question raising are the two essential ingredients of the skill of organization. They are the vital coordinates of comprehensive, problem-oriented understanding of the meaning of information.

As these coordinates begin to function together as a system, note taking begins to function in adaptable and personalized ways. These adaptations include marginal notes in the form of streamlined statements of major ideas as they surface; underlining of the key words in a passage that capsule or suggest the central ideas being developed; or outline symbols (numerals and letters) that indicate ideas that are coordinate or subordinate parts of the whole.

As the unit progresses, participants are introduced to the third phase of their organizational skill—the development of the skills of summarizing and outlining as aids to the comprehension of major ideas in information that contains numerous details of varying degrees of importance.

In summary, as an organizational strategy, participants are required to put into a statement, the essence of their comprehension. This statement must include the central idea that they conceive to be the author's major concern, with the major supportive facts that he includes, and the key words used to indicate whether the relationship of these supportive details to the central idea is illustrative, comparative, descriptive, translational, causal, or consequential. Compression or summary of numerous details into a brief, unified whole that contains the essence of important factual information is a high-level cognitive strategy that is of critical importance to scientific thinking, study, and problem-solving.

Outlining is another strategy which serves the purposes of organized think-

ing and comprehensive learning. It utilizes and strengthens the abilities of trainees to discern and indicate the relationships that ideas bear to each other. They discover that this strategy calls on their judgmental sense: ideas are coordinates or subordinates of other ideas in a value scale determined by central concerns. In matching coordinates with similar numerical or letter symbols to indicate their relative importance one to another, participants are better able to grasp the concept that, as they comprehend generally, important points in the outlined subject matter are retained. Often the more minute details used to develop the important points are no longer necessary. This uncluttering of nonessential details is one of the most valuable learning avenues to survival in the veterinary medical curriculum in which the factual demands are too great for retaining all details as equally important cognitive entities.

In our unit review, we bring the subskills into the awareness of trainees as components of the comprehensive system upon which they will continue to build in every phase of their education. As they use this comprehensive system, they will discover that every study situation is a laboratory exercise in the discovery and use of numerous clues to organization of the author's, the instructor's, and subsequently, the students' own devices for putting their mounting knowledge in order for better understanding and more lasting retention.

C. Analytical or Test-Taking Skills

A cognitive skill which becomes more and more crucial in the development of medical problem-solvers is a system of analysis. This skill begins with the discriminative selection of those meanings within organized information that are pertinent to the understanding and solution of a particular problem. Without this ability, a student may be overwhelmed by the massiveness of his own accumulated knowledge when he confronts a definitive problem; one demanding his ability to identify and define the problem and to use only those elements that are relevant to its solution.

As a problem-solving act, test taking reflects a student's ability to define the problem within a question and through analysis of both the problem and his scientific data base, to select, organize, and explicate only those facts and interpretations that solve the problem. In fact, test taking is the most basic level of the system we know as critical or analytical comprehension for clinical problem-solving purposes.

In our instructional design, formative test taking is the medium through which students are made aware of questioning as the first step in systematic scientific inquiry, in all of its forms and degrees. The unit begins with an emphasis on problem clues (key words) contained within test or study questions. A student must develop the understanding that question or problem clues indicate the direction he must pursue in narrowing the content of his knowledge to accommodate ONLY the demands of a problem defined for him. As he analyzes a question to determine the problem it poses, he learns the functional value of information. He discovers that the significance of information is a variable which must be determined in measures that are relative rather than absolute. What is significant to one study or test question may be irrelevant to another. As he generalizes this discovery, he begins to understand that an instructor's questions signal the relative importance of informational details in a particular course that has been preconceived as a spiraling link within the long-term problem-solving goal perspective. Further, he sees in instructors' questions not only a yardstick for determining the various potential values of information for the various purposes of the course, but also a model for raising study questions for himself as guides to purposeful reading and listening. The degree to which he learns to raise questions before and during study reading is a measure of his ability as a critical thinker and problem-solver.

Included in this analytical unit are several types of test problems which seem to be important to the kinds of thinking and study skills that are long-term requirements in the area of medicine. Early, students confront prob-

lem situations that involve locational skills; the ability to identify, descriptively, important structures; to compare normal and abnormal structures and function; to distinguish between cause and effect as factors affecting medical decisions; and to generalize the numerous facts they are accumulating into principles and concepts.

The unit also analyzes problems in relation to different types of test modes used by instructors as evaluative devices.

A short unit on tests familiarizes trainees with the popular test modes which will be used to evaluate their understanding of scientific information and their skills in processing it in solving test problems. Each of these test types—completion, true-false, multiple choice, matching, and essay—is analyzed as a problem-solving situation and exercised by staffs in both facets and by visiting lecturers who provide questions preceding or following their presentations.

Trainees are instructed in the demands each mode makes on their thinking powers. In the following paragraphs, the basic characteristics of each test are briefly stated to indicate how the test mode is presented to trainees as a problem-solving exercise.

The completion test evaluates recall of pertinent information in relation to the problem clues in the incomplete statement. The requirements of the item may range from a single word response to a list of words. This mode is often used to reinforce terms or facts that are basic, frequently recurring, and stable in nature. Often, substitute terms that are correct synonyms or translations of the response in the course text or in lecture presentations are acceptable responses in completion items.

Trainees are encouraged to note, as they explore and probe subject matter, the types of information that should be reinforced to the point of ready recall because of their basic importance. To reinforce the recall function, trainees also create completion items for discussion and evaluation by peers.

The true-false item as a problem-solving situation is discussed and analyzed. In true-false items, two things or qualities are stated in a relationship to each other that is either true or false. In the statement are clues that aid the test taker in the critical discernment of the correct response. Responding to the word which is the clue upon which the correctness or incorrectness of the statement depends is a crucial step in defining and resolving the problem that the true-false item presents.

Trainees are exercised in responding to true-false items that are presented to them as preparation for creating their own true-false items. These items are then discussed by peers and evaluated as to clarity and substance.

As instruction moves from the true-false test as a problem-solving exercise to the multiple choice mode, trainees are instructed in the common characteristics of the two tests. The multiple choice item is an expanded adaptation of the true-false item. Among the multiple choice options is the response that is correct in relation to the stem. Other options are false. In effectively constructed items, all of the options contain some true elements which may mislead the test taker whose knowledge or understanding is not clear and sure. Critical judgment goes beyond mere recognition of absolute truth or error to a judgment that is more perceptive and relative. When viewed in relation to each other, the nature and demands of each of these tests reinforce the understanding of both as measures of integrated knowledge, generalized understanding, and the skill of critical judgment.

In the matching test, emphasis is placed on the importance of both organization and analysis in the paired relationships among factual information. Determining these comparative relationships is vital to many of the problems of medical and clinical education. This test mode serves numerous types of associative learning. The two columns to be matched may be terms and their definitions; body systems and their components; skill systems and their procedural steps; structures and their functions; normal functions and their pathological deviations; diseases and their symptoms; and other relationships that are the concerns of particular courses.

The analogy test is reviewed here as

an expanded adaptation of the matching test. It exacts a two fold judgment in the pairing of items; the identification of the relationship between items in one pair as a basis of judging or creating a similar relationship in the items of a second pair.

Seeing the same basic thought process in the matching and analogy test reinforces and extends the trainee's skill in both.

Trainees create items of both types for peer practice in responding to them and in evaluating them for their clarity of expression and correctness of conception.

The essay mode is introduced as a test that requires trainees to recall and organize information in relation to problem clues that place on them a wider use of their information. Because the clues are of greater latitutde, the demand on the critical ability of the test taker to stay in focus as he both selects and organizes his response is more critical. Instruction in analysis and organization in essay questions reinforces preceding instruction in note taking, the analysis of key or clue words within a test item, the exploratory skill applied to the scientific data bank for pertinent information, and the organization of this pertinent information in relation to the organizational clues that the essay item always includes. The terms discuss, explain, describe, compare and illustrate are discussed and compared as terms that set problems to be resolved in response appropriately related to the specified organizational clue within an essay type question.

As these test modes are analyzed and exercised in the survival skill facet, they are further reinforced in the science enrichment facet.

Following our emphasis on the skills of organization and test taking analysis as complimentary thinking processes, we review with trainees the comprehensive study system in which these two processes function — the popular study formula which many of them know already as the SQ3R system (Survey-Question-Read-Recite-Review). We emphasize the fact that for the purpose of organization, we survey or explore to establish a unifying framework for integrating the information being enriched into an ever increasing unity of meaning.

Also, in the organization unit, we stress the importance of general question raising in achieving a broad understanding and in expressing this understanding in a compressed but adequate coverage (summary or outline).

In the analytical unit, we carry questioning from the general to the more specific problem-solving purposes for which information is useful. Our emphasis in analytical questioning includes indicating to trainees that general questioning paves the way to specific questioning in scientific inquiry.

In the comprehensive SQ3R system, surveying and questioning are followed with the three R's—reading, reciting, and reviewing. However, in our survival skills facet, we emphasize the fact that the three R's are actually the components of a final step in problem-solving to which we have applied the term RESOLVE. Together the following three major steps have become OUR study formula: EXPLORE-INQUIRE-RESOLVE.

In the following paragraphs, our rationale for each of the three-R components of problem resolution is explained.

The purpose of the first R (reading for study purposes) is to focus the student on obtaining clear impressions of the information being studied. Clear impressions call into use the trainee's multisenory perception of new information, and his interpretations of this information as he seeks generalized meanings.

The second R (reaction or recitation) is problem-solving in nature; it is the EXpression of IMpression as a problem-related response characterized by pertinent content information and appropriate processing skills.

At every level of learning, impressions become active, organized, and functionalized only through responsive expression of impression. Without expression, impressions are inert, and unmanipulative.

Again, questions become an essential, subserving strategy. Questions necessitate and direct the expressive responses that give impressions their

meanings in relation to problems. Discussions, laboratory exercises, diagrams, tests of all kinds are necessary to the kinds of responsiveness that undergird problem-solving. As a subskill, critical and creative response must be rationalized as a process and adequately developed through numerous, diverse developmental exercises throughout the entire program.

The third R (review) represents the final component of the resolve step. It is evaluative in nature. Students should critically judge their performance (their response) to determine its merits in relation to the problem for which the response was an intended solution. Self-responsibility requires a student's going beyond response to a judgement of it — a judgment that requires him to review his performance and improve it by a fresh, wiser look at the information that was or should have been utilized. Standards rise, student by student, through the critical manipulation of the third R in the final step in the comprehensive study format: EXPLORE-INQUIRE-RESOLVE.

We believe that our study formula is a sound system for our purposes. It undergirds the scientific method, and it serves effectively the goal of problem-solving as a thinking/learning system for lifelong medical scientists.

V. BASIC SCIENCE ENRICHMENT

As previously stated, the major goal of the four-year curriculum of veterinary medicine is to produce a truly scientific, problem-solving clinician. This goal involves the development of several high level cognitive processes, which together constitute the scientific method of problem-solving. The central facet for developing these processes is the science enrichment segment of the summer program. Developmental activities of the survival skills and library skills facets are designed to reinforce and facilitate the objectives of 2 three-week phases of the science enrichment facet.

A. Review of the Scientific Method

The objective of the first three-week instructional period is to provide participants an in-depth review of the critical processes of the scientific method with emphasis on the critical importance of each step in medical problem-solving.

The four procedural steps are:

- The systematic collection of scientific information for comprehensive understanding.
- The conceptualization of integrated science information.
- The standardization of scientific information for critical interpretation, evaluation, and reporting through definition and measurement.
- The functionalizing of the fruits of the above steps in medical problem-solving and further scientific research.

The library facet interphases with the science enrichment facet at each of the above steps. Since knowledge of a subject is never complete at any given point of time, students must learn that it is important to their current development and also to their continued professional development to know where to find the information they may need. This is the most lasting outcome of formal education. In the medical profession, in which new knowledge is developing at an exponential rate and much previously accepted information is being disproved, the library as an organized center of learning resources (print and nonprint) becomes the heart of the educative process.

The systematic organization of library resources is revealed to partic-

Mrs. Carolyn Ford, Librarian, explains to trainees how effective use of the library will aid them in their efforts to solve veterinary medical problems.

ipants as background for the effective utilization of the library during and beyond the summer program. Participants become familiar with existing types of learning resources available to them in the library, with how they are organized for ready location and use; and with when and how to use these resources in relation to various types of study purposes and assignments.

The first session of the science unit begins with an instructional tour of the Tuskegee Institute and the veterinary medical libraries. This tour is designed to familiarize participants with the library resources that are the scientist's most basic tools. Included among these tools are the card catalogue, periodical indexes, abstracts, and basic science reference books. The unique nature of each of these tools; the purposes they are intended to serve; and some of the characteristic features which determine when, how, or if they should be utilized for particular study purposes are all objectives that the library facet is designed to achieve in cooperation with the staff of the science enrichment facet.

Following the library tours, the library staff presents a transparency depicting the links in the bibliographic ladder or chain. Students are shown how to start with an idea and carry it through possible printed links until it becomes a part of a body of knowledge. Through this device, students become aware of the various forms of printed scientific information and their relationship to each other in terms of time span and use.

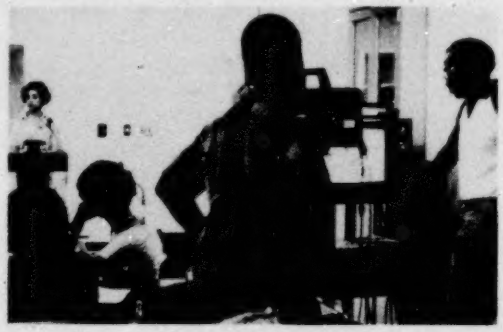
Next, a five-lecture series is presented by a basic science professor assigned to review and enrich the component steps of the scientific method.

In the course of the five lectures, participants begin to understand terms that represent important concepts and processes. Further, they develop a sense of the importance of a critical understanding of the changing nature of what was once an acceptable current concept before it was replaced by later, current concepts resulting from new scientific investigations. They learn, too, the necessity for suspended judgment in relation to conclusions that are hypothetical in nature; and the techniques by which scientists qualitate, quantitate, and evaluate information for reporting it for future retrieval.

Class discussions and question and answer sessions following these lectures provide opportunities for supplementary information from the backgrounds of participants, and for integrating additions into the new terms and facts resulting from the lecture series.

Early in the lecture series, a library practicum is assigned. Each participant is assigned a searching problem which he will explore during the afternoon sessions that are devoted to the library facet. With available assistance from the library staff, each participant undertakes his searching process as a problem-solving experience which utilizes the following critical steps:

- Determining that a need for information exists.
- Stating the question (or problem) in its initial form.
- Delimiting and redefining the question.
- Stating the redefined question.
- Structuring the search.
- Selecting most suitable information sources.
- Analyzing information sources selected.
- Obtaining additional information if necessary.
- Synthesizing information.
- Analyzing information.
- Making decisions.
- Evaluating the effectiveness of the search.



A trainee responds to questions from participants in the program while video crew tapes her presentation.

— Preparing report.
— Presenting report.

As participants move through these steps, they utilize most of what they have learned during the earlier parts of the program. When difficulties are encountered, trainees and staff realize that further reinforcement is needed in the processes of locating and analyzing information, and of developing a report for presentation.

Each participant's presentation is judged on the basis of clarity and the quality of the participant's responses to questions raised by the class about his findings. The trainee's defense of his conclusions based on his findings is also judged.

All the presentations are video taped and later played for each trainee's self evaluation. The opportunity to view himself and his presentation offers the trainee evidence of areas in which he can improve. Often, also, he begins to gain the confidence needed to speak in front of an audience.

The library practicum is a lively experience in which participants move freely in search of informational solutions to their assigned problems. This search brings them into purposeful contact with tools to which they have been introduced. As they work individually and cooperatively in resolving search problems, they discover that different problems call into use different types of tools. They find that for some topics, much material is available, and for others, very little. They may also find that for some topics, available information is not sufficiently recent to be accepted as representative of the most current scientific information on the subject and that various researchers of a particular topic draw such different conclusions that a critical analysis of the scope and quality of their research is necessary to the critical interpretation and utilization of reported research.

The science/laboratory practicum is a formative and summative exercise of the scientific method as a comprehensive study system.

The second unit of the first three-week phase of the scientific enrichment facet is designed to reinforce and enrich students in the comprehensive processes involved in the third step of the scientific method: the standardization of scientific information for critical interpretation, evaluation, and reporting.

All participants bring to the program some knowledge of quantitative terms and processes. For many, this knowledge is fragmentary and unrelated to the types of critical applications that serve scientific problem-solving.

During the week devoted to instructional activities in the qualitative and quantitative strategies of standardizing scientific information, students learn the importance of their basic organizing skill. A flow chart is introduced as a model of sequential organization of information. They review the metric system as the standard mathematical language used in measurement and they learn how to convert the English system to the metric.

In data analysis, they discover the crucial importance of critical interpretation of tabular and graphic presentations of scientific data and of statistical measures of average and variable behavior. They discover, too, the importance of various norms — percentages and percentiles — in standardizing widely different quantities.

Lectures are supplemented with various related library assignments, print and nonprint. These include films on the metric system, conversion tables, and articles utilizing graphs and tables of various types.

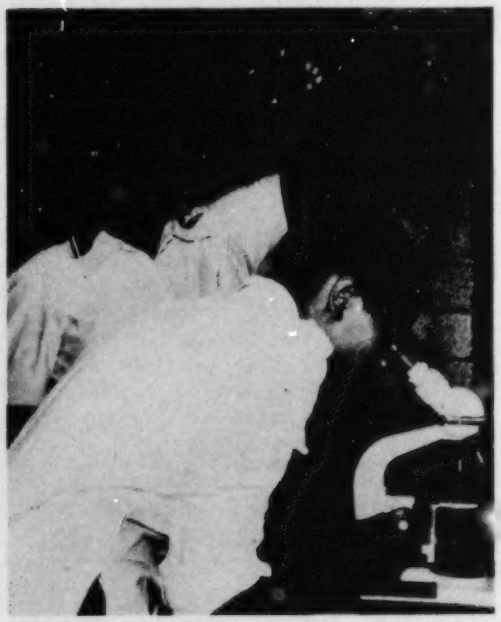
Trainees use the audio visual laboratory to view video tapes on various aspects of the veterinary medical curriculum.

Dr. William Johnson, Director of the Multi-Disciplinary Laboratories, shows trainees how to adjust the equipment for better viewing.

Daily assignments involve note taking and formative exercises in interpreting or constructing various forms of quantified information. Feedback discussions provide opportunities for clarifying those processes and principles that are not mastered by individual participants.

Qualitative standardization of information involves students with the importance of definition in scientific study, reporting, and problem-solving. A field trip to the large animal clinic provides an opportunity for participants to encounter the problems of definition and description in reporting their observations. Careful note taking and refinement of impressions and notes into precise, definitive terms require a skill that is important in clinical medicine. Terminology becomes as crucial in qualitative standardization as in quantitative. Library tools support participants in locating accurate, definitive and descriptive terms as models for the development of their own powers in qualitative standardization of information from various sensory experiences.

In the final session of the first three weeks, all systems studied are reviewed with emphasis on how they operate as manipulative, adaptable parts of the composite system of scientific problem-solving. Both the study processes emphasized and the enriched informational contents that result from the processing activities of the coordinated science and library facets are summarized as cumulative reinforcement of their functional value. Terminology, note taking, locational, organizational, analytical, and evaluative skills are all stressed again in the unit's summary as study strategies that fuse in various combinations to support the pursuit and processing of knowledge for various scientific purposes. This concluding synthesis of basic contents and processes resulting from all three facets during the first three-week instructional period, provides a meaningful springboard to the interdisciplinary cell practicum which culminates the six-week summer instructional program.



In the Large Animal Clinic a trainee and Dr. Cuthbert Padmore evaluate frozen semen.

Dr. Cuthbert Padmore, Head of Large Animal Medicine, explains the percussion of the sinuses in the physical examination of a horse.

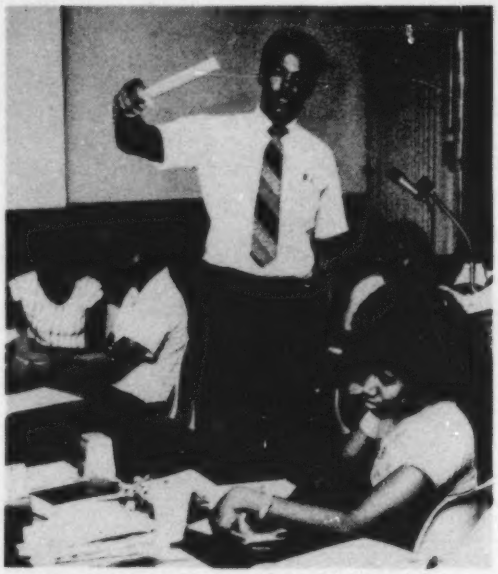
Dr. Eugene Adams, Associate Dean, lectures on cancerous tumors in canines during one of his frequent sessions with trainees.

B. Cell Conceptualization Practicum

The interdisciplinary conceptualization of the cell as the central element of all life, represents a deliberate coordination of the three facets of the program. Numerous factual details on the structure and function of normal cell life and the pathological deviations which are the concerns of preventive and clinical medicine are emphasized.

The cell practicum is designed to utilize and control the entire scheduled day, to the extent required by instructors of the four divisions of the study of the cell. Staffs of the survival skills and library facets are available daily to provide related support as needed in an involvement of participants in the process of conceptualization as a lifelong critical thinking/study system. The process represents a spiral progression through the content hierarchy of the medical sciences: normal structure, normal function, pathological deviations from functional normalcy, and medical resolutions of pathological conditions of animals. At the same time, the conceptualization practicum presents a spiral progression through the hierarchy of processing skills: the literal comprehension of masses of scientific information; the interpretation of literal information for generalized understandings in the forms of concepts, principles, and conclusions; the judgements of information for its validity, reliability, and relevance to particular study purposes; and the application of interpreted information in subsequent study and problem-solving.

Trainees get the benefit of Mrs. Georgia Poole's 30 years of experience in teaching students how to organize and retain vital information.



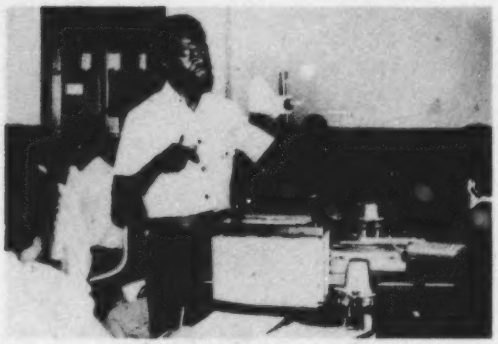
Dr. George Heath, Professor, discusses the effects of drugs on the cell and sub cellular structures.

Like each of the preceding phases of the program, the cell practicum begins with an introduction in which the rationale, perspective, objectives, and planned instructional sequences are clearly set forth within a tentative time frame. This introduction is a preview of the important conclusions which their four-unit study of the cell will support. The units reveal

In the laboratory, trainees observe microscopic pathological lesions.

that organisms are collections of cells organized by types, numbers, and location; that the function of cells is closely related to their structure; that it is the multiplication, movement and differentiation of cells that lead to the development of organisms; and that all of the disciplines within the medical curriculum contribute to the scientific conceptualization of the cell as the basic element of life.

The practicum then proceeds through the four units that constitute the interdisciplinary study of the cell. Each unit is taught by a regular faculty member of the particular discipline.



Dr. Gregory Chibuzo, Associate Professor, discusses the anatomy of the cell with trainees.

In the first unit, emphasis is on characteristics of normal cell structure. Students review, in depth, basic anatomical terms with which they are familiar from previous courses and correct some of the typical misconceptions resulting from limited information relative to changing theories affecting current concepts of the nature and interrelationships of anatomical characteristics of cell elements. New terms are introduced, defined, and conceptualized with other meanings as they evolve.

Practical learning activities include demonstrated lectures, microscopic viewing and discussion of selected slides, formative test exercises based on the information included in the lecture series on cell anatomy, and a final summary reinforcement of those facts that are important as links to the immediately following unit on normal cell functions.

The second unit is devoted to the physiological nature of cells. Participants develop an understanding of the differential characteristics of cell functions in relation to tissues, organs, and systems; their roles in the control of growth, reproduction, energy transformation, and synthesis of proteins. They receive further instruction on the changes in the functions of the cell induced by the action of drugs and toxicants, and the medical significance of these induced changes.

Dr. Om Verma, Head of Physiology and Pharmacology reviews the physiology of the cell with students.

Emphasis is placed on the development of an adequate vocabulary of physiological terms that symbolize important scientific facts relative to normal cell functions. Library assignments supplement lectures and stimulate discussions and questions as participants gain in depth understanding of informational details that were previously fragmented or misinterpreted.

A cumulative test serves both formative and summative purposes in the integration of the anatomy and

physiology of normal cell life as the background for identifying, diagnosing, and resolving pathological conditions that are the concern of the medical practitioner. Performances on the cumulative test indicate whether trainees need to master information that will help them understand the third unit.

The third unit introduces participants to the discipline which is concerned with malfunctioning conditions of cell life. The unit is organized to provide a sweeping exposure to large amounts of organized information on the various kinds and causes

In the necropsy laboratory trainees observe pathological lesions demonstrated by Dr. Albert Dade, Professor.

Dr. Dade shows trainees how to use the video system to monitor the cell.

of cell pathology. Numerous new medical terms are encountered and are studied through lecture contexts, and categories of terms in relation to the diseases to which they apply. Slides utilized in this unit facilitate the conceptualization of such aspects of pathology as typical causes of cell injury, cellular mechanisms affected by injurious agents, events in cell injury, normal cells versus sick cells, and cellular death.

Dr. Calvert Jeffers, Assistant Professor, demonstrates examination procedure for small canine.

The last lecture of the unit deals with pathogenesis of ischemia, during which participants are carried through stages of coronary thrombosis from its inception to its termination. Related to this lecture are two practical activities. Participants visit the clinic to view a sick animal and to note whether there are observable signs of deviations from the normal. They also visit the necropsy laboratory where they observe the procedures employed by the pathologists in ascertaining the cause of death. These two practical experiences synthesize important information gained from the three units — structure, function, and malfunction — and are transitions to the unit on the role of immunology in health and disease which concludes the cell practicum.

During the lecture series on immunology, trainees receive instruction about the organs and cells involved in the immune response. They learn how different cells function in the immune response, and the different types of immune responses that are medical concerns — immunology of reproduction, immunology of cancer, immunology of development and immunology of transplantation. The lectures integrate science infor-

mation from all of the preceding disciplinary units, and demonstrate to the trainees the fluidity of the contents of their scientific data bank in the conceptualization process. Trainees experience the importance of a rich scientific vocabulary and of its continual growth to accomodate new information. They experience, too, the importance of processing skills in organizing, interpreting, and functionalizing an ever-growing information base.

The practical outcomes which the practicum is designed to achieve are facilitated and functionalized by appropriate formative tests that are incorporated into each of the units. Tests in each unit are exercises in the cognitive process essential to the objectives of that unit.

The anatomy unit is a natural vehicle for reinforcing students in the ready recall of essential information on the nature and location of normal cell structure. In an effort to reinforce test taking, students learn that completion tests are most useful as recall exercises. These test items may vary from one-term responses to the listings of numerous components of various anatomical categories. Recognition test items (true-false or multiple choice) add judgment to recall. Formative essay items present problems of description, definition and location of structural parts.

The front lawn of the School of Veterinary Medicine provides an ideal spot for trainee Darryl Mickle to relax.

The units on function, pathology and immunology involve critical thought processes. Comparisons, interpretations and judgements are well served through multiple choice formative test items. The trainees' clarity and precision of knowledge of terms, facts and principles are challenged through these options. Well constructed true-false and matching items provide further formative exercises. Essay items have increasing usefulness as units progress. In an effort to articulate their understanding through comparisons of normal and abnormal functions; characteristic likeness and differences among symptoms or causes of diseases; or procedures for remediation of these diseases, participants discover various inadequacies in the contents of their data bank or in their processing skills. This is the major value of formative tests as instructional strategies. Self-discovery of inadequacies stimulates self-responsibility, and motivates, directs, and disciplines participants in their efforts to become independent and competent learners.

In our continual use of formative tests as inherent aspects of each unit, our participants discover that test taking is problem-solving at its most basic level, and that through these tests they are developing the skills upon which their competency in medical and clinical problem-solving will depend.

In the summary session at the end of the six-week instructional period, note taking, terminology development, literal comprehension, conceptualization, and test taking are all reviewed as subsystems that function in the comprehensive system which constitutes scientific thinking and study.

VI. PROGRAM EVALUATION

A. Short-Term Evaluation

The eighth week of the program is devoted to postassessment of each of the functions that were preassessed during the first week of the summer session.

The scaled scores from these two tests (pre and post) are placed in parallel columns, function by function, to reflect the developmental changes in these functions during the six-week

period of instruction.

The following class scales for the three skill objectives of the survival skill facet contain preassessment and postassessment scaled scores made by 18 trainees. An analysis of these comparative data indicates several important observations (Table 1).

In the skill of organization, the class ceiling rose from 90 in the pre-test to 97 in the post-test — a gain of 07 percentile points. There is a significant drop in baselines from a low of 15 in the pre-test scale to 3 in the post-test. The post-test scale has a larger range (97-3) than the pre-test (90-15).

In reading discrimination, the class ceiling is two points higher in the post-test; the spread is two points wider; and the lowest baseline remains unchanged.

test, and a perfect post-test score of 100 out of 100 items made by 12 of the 18 trainees.

In our interpretation of these developmental changes in medical vocabulary, we recognize several factors that contribute to these unusual results — the specificity of the learning tasks, the carefully designed sequences, the frequent reinforcement of skill elements, and the self-instructional nature of the programmed text. These features have been noted as representing pedagogical principles that can be adapted to other areas of development in our program.

It should be emphasized here that the pre- and post-test score scales cannot be viewed as horizontal pairs representing the before and after levels of individual trainees. The scales

Table 1

Class Scales in Survival Skills for the Pre- and Post-Tests

STUDENTS	READING STUDY SKILLS				MEDICAL TERMINOLOGY SKILLS	
	Reading Comprehension		Reading Discrimination		Structure	
	Pre	Post	Pre	Post	Pre	Post
1	90	97	95	97	81	100
2	90	97	70	95	71	100
3	90	95	70	90	64	100
4	85	95	68	80	64	100
5	85	90	55	80	62	100
6	80	90	50	80	61	100
7	80	90	45	80	59	100
8	78	90	35	75	59	100
9	77	80	22	70	59	100
10	70	80	22	65	55	100
11	70	77	15	60	50	100
12	65	77	8	60	44	100
13	65	70	8	50	40	98
14	50	65	8	50	39	98
15	35	65	7	45	33	98
16	35	40	7	40	29	98
17	30	40	3	25	28	96
18	15	3	3	3	20	90

The most drastic developmental change appears in the medical vocabulary skill: a ceiling increase from 81 in the pre-test to 100 in the post-test, a range change from 81 to 20 in the pre-test to from 100 to 90 in the post-

merely reflect, separately, the class distribution from the highest to lowest score.

To reflect progressive changes, we tabulate evaluative data for each trainee. In the first column, we record the

initial score in each of the three skills; in the second column, the post-test score; and in the third column, the amount of progress as reflected in the difference between pre- and post-scores.

Following are progress scores of three students on the three survival skill tests. A comparison of these progress scores indicates two significant variables in learning—the difficulty of the skill itself and the difference among trainees in learning momentum (Table 2).

We indicate to trainees that for students whose scores are high in the pre-test, the margin of possible progress is much smaller in the test instrument than for students whose pre-scores are low. It would not have been possible for trainee "B" in Table 2 to have improved as much in Paragraph Reading as trainees "A" and "C" on the particular test instrument used, which has 97 as its maximum percentile score.

The above fact is significant in the interpretation of evaluative data. The momentum of learning change that is reflected in a progress score should not be used as a measure of the level of skill development that is reflected in the actual score in a post-test. Trainee "B", with a zero progress score, has a post-test skill level at the 90 percentile; trainee "C", with a surprisingly high 30 percentile progress score, has a post skill level of 65. As we interpret our assessment of learning, we need to be concerned with the level of a trainee's skill development in relation to curriculum demands as well as with his learning style and momentum.

Another short-term evaluation of the summer program is a comparison of pre-assessment scores on the June VAT with scores on the VAT administered in September to all entering first-year students.

Eleven summer trainees were admitted into the program. Table 3 includes combined percentile scores on both tests and the margin of change that represents the amount of progress of each of these 11 students from our summer program.

Although three percentiles appear unchanged (students 6, 8, and 11), the raw scores on each post-test are higher than the pre-test raw socres, though not increased enough to change the percentile score.

There is a significant change in the post-test percentiles for the other eight trainees, varying from an increase of 25 to 01 in percentiles. Based on these changes, we may conclude that our instructional program effectively serves the objectives we seek.

During the last class session, trainees evaluate various aspects of the summer program. These reactions are informal and unrestrained. Many of our improvements from summer to summer have been the result of sug-

Table 2

Individual Progress Scores of Three Summer Trainees

	Pre-Test	Post-Test	Progress
STUDENT A			
Paragraph Reading	50	77	27
Reading Discrimination	65	65	0
Structural Analysis Skill	28	100	72
STUDENT B			
Paragraph Reading	90	90	0
Reading Discrimination	55	90	35
Structural Analysis Skill	62	100	38
STUDENT C			
Paragraph Reading	35	65	30
Reading Discrimination	8	50	42
Structural Analysis Skill	40	96	56

Table 3

Class Progress Scores on VAT

STUDENT	COLUMN I June Scores	COLUMN II September Scores	COLUMN III Progress Scores
1	30	(not taken)	--
2	20	40	20
3	20	45	25
4	05	25	20
5	05	10	05
6	05	05	0
7	02	05	03
8	02	02	0
9	01	02	01
10	01	05	04
11	01	01	0

gestions from trainees that are based on their awareness of cognitive needs. Comments on the strengths of the program have also proved helpful in assuring us that we are developing effective instructional approaches to the solution of many of the cognitive deficiencies of trainees.

Quotes from students:

A unique experience was... the extended battery of tests given at the outset. Never before had such test data been interpreted to me. Knowing the results has helped me recognize weaknesses and strengths. Probably the greatest gain was developing study skills... I have never had previous experience in this area.

When I first came to the program, my studying was aimless and I was easily bored... Studying was a chore... I didn't even know there was a system to help you study.

During these weeks, I've developed something I never had before — the interest for studying — a system for retaining what I studied... Now I can take notes from a lecturer.

I have learned to set a purpose when I study... I've acquired new attitudes... am doubly motivated... have an inner feeling of accomplishment... am learning many new things.

I have never felt this way about learning, listening and note taking. The skills I'm learning in this program are exciting.

Upon entering this program, I felt that I had good study skills, but after comparing my skills with skills being taught, I found little similarity.

The members of the summer staff also evaluate each summer program in light of suggested improvements of preceding summers. These evaluations of the features of the summer program that have implications for strengthening the efforts of the total faculty in every aspect of our curriculum reform goal are compiled and included in the annual report to the faculty.

B. Long-Term Evaluation

The success of the summer program in relation to the goals of curriculum reform must be determined by measures that go beyond the short-term evaluation based on immediate post-test and progress scores. Scores immediately following instruction often prove deceptive as measures of cognitive strength that will persist beyond a program based on intense reinforcements of isolated fundamentals. A more valid assessment of the effectiveness of the summer program is the degree to which it facilitates survival when students encounter large amounts of scientific information in several basic medical science courses. The amounts make severe demands on the students' ability to organize, retain, and utilize the facts in relation to the different types of evaluative tests and medical problems used by instructors.

Like students in general, high-risk students are unique in their learning characteristics; in the degree of their motivation; the moment of their awakening to a new learning situation; the momentum of their developmental changes; and their power of transfer of the meaning of one experience to the conditions of another situation. These are the subtle factors of behavior that operate for or against a student's continuing success beyond the immediate gains of the summer science enrichment/survival skill developments of the pre-entry program.

Three measures are significant as means of determining the effectiveness of the pre-entry program in relation to the two long-term goals of curriculum reform which are to reduce the high attrition rate among academically disadvantaged recruits and to produce professionally competent, self-continuing veterinary practitioners. These three long-term criteria of program effectiveness are cumulative grade point averages, performance on accrediting board examinations, and the records of employment of summer trainees.

The first criterion (grade point averages) is applicable to each of the five summer classes of 1975-1979. The remaining two criteria (accrediting board examinations scores and em-

ployment records) are applicable only to trainees of the summer of 1975 who are members of the graduating class of 1979.

1. **Grade Point Averages of Pre-Entry Students, 1975-1979**

The following table (Table 4) provides a year-by-year summary of important data on 1975-1979 summer trainees admitted into the program. An analysis of these data reveals several significant facts:

a. Among trainees admitted to the pre-entry summer program as high-risk students on the basis of academic records and supportive information (interviews), there are wide differences in the aptitudes measured by the VAT. This fact is evident in the range of scores, class-by-class. By the same measure, it is clear that there are class differences in range, viewed as a whole. One trainee tested an average of 99 percent on the VAT in the 1976 group, while the highest average score in the 1978 group was at the 30 percentile.

b. Among per-entry students in each class, there is a significant number at the 02 or 01 percentile level, a level from which other institutions would not accept students and the level which accounted for the large attrition rate of students in our program before the years of curriculum reform.

Half of the class of 1978 was below 05 percentile on the VAT taken at the beginning of the program. Except for the 1977 summer class, at least one-third of the students from pre-summer programs tested below a combined percentile score of 05.

c. The attrition rate, class by class, reflects that initial academic disadvantage is not predictive of the potential of high-risk students when given the opportunity to remediate basic skills before entering the formal program. Survival in the program ranges from 89 percent to 71 percent among pre-entry students of the five years covered in this report.

TABLE 4

SUMMARY OF EVALUATIVE DATA ON FIVE PRE-ENTRY SUMMER CLASSES (1975-1979)

Year	Total Summer Trainees Admitted	Range of VAT Average Percentile Scores	Number and % of Students Below 05 Average Percentile Score	Number and % of Summer Students Dropped	Number and % of Survivors	Number and % on Dean's List (3.0 or above)	Range of Cumulative G.P.A.'s at end of 1979-80 School Year
1975	12	65-01	4 (33%)	2 (17%)	10 (83%)	4 (33%)	3.65-2.44
1976	14	99-01	7 (50%)	2 (14%)	12 (86%)	5 (36%)	3.63-2.51
1977	9	50-05	0	1 (11%)	8 (89%)	2 (22%)	3.31-2.12
1978	12	30-01	6 (50%)	3 (25%)	9 (75%)	0	2.79-2.16
1979	14	50-01	6 (43%)	4 (29%)	10 (71%)	3 (29%)	3.31-2.10
Totals	61	99-01	23 (38%)	12 (20%)*	49 (80%)	14 (23%)	3.65-2.10

*Ten Trainees Below 05 Percentile (VAT)

d. The summer design provides opportunities for trainees to utilize both instructional and autotutorial provisions for fullest development during the eight-week period. The progress scores reported in the short-term evaluations indicate wide developmental differences

among trainees. Both cognitive and noncognitive factors influence these differences. The cumulative grade point averages continue to reflect the effect of these factors. In four pre-entry groups, there are students on the Dean's List (average of 3.00 or above). The percentage ranges from 36 in 1976 to zero in 1978. Our program seeks to facilitate maximal development of students of varying cognitive and noncognitive powers, not mere survival. The Dean's List evidences the release of above average potential of a sizable number of initially high-risk sutdents.

e. Within every class included in the summary data on Table 4 are individual developments that defy rigid generalizations about the potentiality of academically disadvantaged recruits for professional education. Only twelve (20%) of the 61 pre-entry students admitted from 1975-1979 were dropped from the professional program for unsatisfactory performance. Ten were discontinued during the first year and two during the second year.

The tutorial program has been designed to continue needed support to summer and nonsummer students who experience difficulties during the crucial first two years of the program. Survivors of this period generally progress satisfactorily to graduate, and their cumulative grade point averages reflect that they gain academic strength as they move from the first year through the curriculum.

2. Performance on Accrediting Board of Examinations and Employment Records

The most important single criterion of any professional program is the extent to which the graduate is prepared to function as a competent professional. In our program. two measures are used as post graduate evaluations of the curriculum in relation to the major goals of curriculum reform: (1) the performances of graduates on the National Board Examination and the USDA Accreditation Examination; (2) the employment records of graduates. These two evaluative measures have been applied to pre-entry students of the 1979 gra-

Table 5

1975 Summer Program Trainees (1979 Graduates)

Trainee	State Boards Passed	Employment	Location
1	North Carolina	Laboratory Animal Medicine, Intern University of North Carolina, Chapel Hill	Raleigh, NC
2	Alabama	Mixed Practice with Veterinarian	Elk Point, SD
3	Michigan	USDA NAtional Animal Disease Center Research Center, Research Assistant	Ames, IA
4	Georgia, Tennessee	USDA—Regulatory Medicine	Fort Myers, FL
5	Alabama, Georgia, and Maryland	USDA—Regulatory Medicine	Beltsville, MD
6	Alabama, Georgia	USDA—Regulatory Medicine	Birmingham, AL
7	Alabama	Regulatory Medicine	Georgetown, Guyana
8	Pennsylvania (Temporary License)	Small Animal Practice with Veterinarian	Germantown, PA
9	Florida, Georgia	Smal Animal Practice with Veterinarian	Miami, FL
10	Alabama	U.S. Army—Captain, Veterinary Corp.	San Antonio, TX

*All trainees passed National Board Examination and USDA Accreditation Test

duating class — our first HCOP graduates at the time of this report.

Table 5 includes data on the 1975 summer trainees in relation to both accrediting board examinations and the records of employment of the ten 1975 pre-entry trainees who grduated in 1979.

To be able to practice veterinary medicine, graduates of veterinary medical schools must sit for two separate boards — National Board of Veterinary Medical Examiners, and the specific state board examinations. In addition, the USDA Accreditation Test must be passed before a graduate veterinarian is permitted to perform tuberculosis or brucellosis tests or prepare health certificates for interstate or international shipment of animals.

At the end of the Summer Program trainees and staff enjoy a social hour.

VII. SUMMARY

A. Student Development

The pre-entry summer program described in the preceding pages can be best summarized in an analysis of three pedagogical guidelines that represent the fruits of our experimental summer efforts to reinforce and enrich the vital professional aptitudes which educationally disadvantaged enrollees often lack. We believe that these three guides are our answer for substituting systematic approaches in medical and clinical education for the fragmented, surface learning contents and skills which undermine survival in the program. Each of these guides will be briefly discussed to reflect its value and use in the strengthening of our instructional design.

1. **Goal Perspective**

From the first orientation session with our trainees and throughout the entire summer program, we emphasize the importance of a long-term curriculum goal, and a goal perspective that sets forth the major components in a meaningful, sequential relationship. This approach is valuable in establishing a framework for integrated understanding that can be enriched and functionalized in relation to our professional goal.

We know that all of our trainees have amassed many bits of scientific information. The long-term goal of a scientific problem-solving veterinarian requires much more. We seek broader outcomes through an early orientation of our trainees to the goal of veterinary medical education and its major components. Trainees learn what the components are and how they relate to give unity and coherence in their spiraling progression through the critically conceived curriculum sequences.

A flashback to our early statements in the summer program perspective shows that we have designed each step of instruction in our facets to keep foremost in trainees' minds the importance of day-to-day information in its functional relationship to an enriched integrated basic science data bank and basic and critical thinking systems. Even our reinforcement activities are planned to continually merge immediate learnings with previous and later learnings in a continuum that has the scope of goal perspective.

2. **Coordinated Reinforcement of Major Goal Components**

The countering of deep-set, ineffective patterns of cognitive behavior requires an intense reinforcement of a more effective substitute pattern. This reinforcement cannot be adequately accom-

plished without a concerted effort based on a staff-wide understanding of the nature of the systems being sought and the ways and means by which these systems can be reinforced and functionalized in each phase of the summer program.

Our detailed activities include the numerous ways in which we work coordinately in strengthening our common concerns for an integrated, enriched data bank of scientific information and scientific processing skills. Our staffs plan and work together to give the kinds of cumulative reinforcements that expand the grasp of meaning and diversify the functional values of information in both facets.

We have become more and more convinced of the dynamic results that are possible through total staff cooperation and coordination in reinforcing, enriching and functionalizing the important components of scientific problem-solving.

3. **Instructional use of Tests in the Development of Problem-Solving Skills**

A well constructed test item contains all of the essential elements of problem-solving. In every test item there is a problem clue within the item. There is a solution to be sought through an exploration of available informational data. There is a need for a critical narrowing of this information to the facts and understandings that are relevant to the specific problem, and there is the task of developing the appropriate solution response that the problem calls for in its directions.

As the program report shows, we use tests as an inherent part of all of our instructional activities. Our pre-tests reveal to us the needs of trainees in relation to test or study problems. The individual profiles reveal priority needs of class and individuals, and establish baselines for each trainee as a measure to be used in assessing his progress in later formative tests that are used as instructional problem-solving exercises.

We see in tests numerous instructional uses in the development of scientific thinkers and medical problem-solvers.

Goal perspective, coordinated reinforcements, and the instructional uses of tests all have given our design a cohesiveness and spiraling progression that we consider vital to our long-term problem-solving goal.

B. Faculty Development

The strength of an educational program is in the quality of its instructional staff. Media play their part, but instructors determine the extent to which instructional goals, courses, and activities work together to produce an effective learner, a critical thinker, and a competent professional.

Our summer staff is a stable one. We have worked together during several summer programs, and we have grown together in educational insights relative to both the typical needs of our trainees and the kinds of educational experiences that are promising answers to these needs. Each summer, we have evaluated the results of our efforts and used these evaluations to project improvements for the next summer. Annually in an early fall meeting of the veterinary faculty, we have presented, in summary, our summer goals, successes, and projected improvements. Expressions of faculty interest have resulted in our development of a series of faculty in-service meetings to share and discuss implications of our experiences for improving the efficiency of our total instructional program.

Our in-service meetings are deliberately planned to prepare the faculty in the areas of the guidelines upon which our summer program is based. The emphasis of these meetings as avenues to a common goal (problem-solving) will be summarized in the following paragraphs.

1. The Importance of a Long-Term Problem-Solving Curriculum Perspective

The concern of our first in-service meeting in the series was the establishment of our long-term curriculum goal: scientific and clinical

problem-solving. The rationale for the wording of this common goal is its emphasis on what the trainee should be able to do, not merely on what he should know and believe. Its focus is active and functional, and it sets in motion subfunctions that must be identified and developed as procedural parts of the more comprehensive act of problem-solving.

A common long-term goal necessitates a common perspective within which the essential major goal components are identified and clearly conceived as interrelated parts of a whole. Setting and keeping a goal perspective that is inclusive of important systems of scientific knowledge and skills are both requisites in a problem-solving curriculum.

During the in-service presentation on the importance of a common goal and goal perspective, we indicated the importance of systems of both scientific content and processes. In the content hierarchy we emphasized the role of each of the four medical disciplines in the spiral progression from normal anatomy and function to functional abnormalities and clinical medicine. In the skill hierarchy we emphasized the critical thinking processes that convert factual information to generalized meanings, values, and problem solutions. We isolated these processes to establish for each a rationale, a common understanding of its nature, and a common responsibility for its development.

2. Coordinated Reinforcement of Major Goal Components

Our in-service meeting on coordinated instruction focused our attention on a critical review of three original curriculum reform components: course syllabi, tutorials, and the AT/AV laboratory. To each of these reform components we raised for ourselves the question: In what way does our emphasis on problem-solving as our common goal necessitate revisions of the particular component?

a. **Course Syllabi**

In reviewing the original purpose of syllabi as course cores of essential meaningful links to next-level cores, we realized that our syllabi have not been as critically designed and utilized for this purpose as our new goal emphasis requires.

A syllabus core should be basic, ongoing, essential information which lectures, discussions, and assigned supplementary reading should expand and reinforce. These core contents should constitute references to which students may return in pinpointing and refreshing information that provides a background for grasping the core information within a syllabus of a later course. The syllabus core of each course should relate to the cores of preceding and subsequent courses in a way to smooth the transition from one body of information to another in a spiraling progression from basic sciences to medical problem-solving. In the in-service meeting on improving syllabi we emphasized the need to reexamine this instructional device in the light of problem-solving as our goal and to revise the selection and organization of syllabi cores in whatever ways we may improve them in coordinating our subject matters and our processing activities.

Some of our faculty have accepted the challenge and responsibility of revising their individual syllabus to improve its usefulness as a coordinating device.

b. **Tutorials**

In our original curriculum reform plan we included tutorials as a medium for facilitating the survival of high-risk students in the first two years of their professional education. Our first concept of the role of tutorials was that they would provide a kind of supplemen-

tation of lecture and syllabi information. Though it was expected that tutors would work in cooperation with instructors in providing this supplementation, their roles and activities were not clearly defined, and not sufficiently coordinated with the goal of scientific problem-solving. Consequently, we have taken a closer and more coordinated look at ways of improving our tutorials. We feel that an instructor and the peer tutor should be an instructional team in providing the kinds of complementary and/or supplementary help that tutees need in their academic development in each basic science course. To achieve goal-related improvements in our tutorial program, we have recommended scheduled weekly conferences between the instructor and tutor of each course involved; and weekly reports indicating attendance of tutees, the purpose of particular tutorials, and successes and failures in the light of the objectives set for the tutorial by the faculty/peer team. Our faculty/peer tutorials have functioned in various ways to achieve better coordination of efforts in relating to class and individual needs. Several teams have developed effective tutorials that will be used as models for other tutorials.

c. AT/AV Laboratory

Our autotutorial/audio-visual laboratory is a reform component of our original curriculum reform plan. Since its inception, it has passed through numerous progressive changes. We now have a more desirable physical facility in size, attractiveness, and accessibility. We have continually increased our holdings—commercial and locally developed. We have also acquired a larger AT/AV staff to provide needed services in organizing holdings for instructional and auto-instructional uses.

As our in-service meetings have emphasized the long-term perspective as a unifying framework for syllabi and tutorials, our staffs have seen the need to take an insightful look at the AT/AV laboratory as a versatile coordinating medium. Programmed Logic of Automated Teaching Operations (PLATO) is a recent addition to our systems-approach to learning-to-learn techniques. Trainees are introduced to PLATO system's dynamic and intensive computer-based individual instruction which allows for greater freedom in learning. Immediate feedback and self pacing are provided so that they are able to move at their own pace. Special programs developed by our faculty dealing with specific learning deficiencies that the minority student brings to the university are being adapted to the computer. Our new emphasis includes print and non-print resources.

Together the two constitute the basic core of the scientist's problem-solving resources. Both types of media are expanding to include tools that will teach and review students in vital information they will encounter in lectures, course syllabi, laboratories, tutorials, and tests.

In addition to the uses of syllabi, tutorials, and library resources (print and non-print) in coordinating instruction for problem-solving purposes, we have discovered the coordinating value of the unique resourcefulness of students themselves. Before our curriculum reform objectives forced us to examine our teaching goals and methods, we were inclined to depend on lectures as our main instructional method. More and more we are realizing the greater gains that accompany active involvement of students in every phase of

their education. In more and more courses we are activating students to inquire, discuss, probe, evaluate, and even challenge. These are vital processes in learning by discovery and interaction. Our summer program, which utilizes active involvement of trainees in give-and-take learning, has substantiated the principle that we have tried to make faculty-wide: that students themselves are vital resources in the contents and processes that constitute scientific development, and that only to the extent that their resourcefulness is tapped and utilized in coordination with class instruction will students become self-responsible and self-continuing professionals.

3. Instructional Uses of Tests

Because of the importance of test-taking experiences in relation to our long-term goal, we have made the construction of problem-oriented test items a major concern of our in-service meetings. We have devoted five meetings to faculty-wide conceptualization of tests as developmental avenues to problem-solving.

Our first meeting on the instructional uses of tests was devoted to developing a rationale for our emphasis on formative classroom tests in improving the effectiveness of our total problem-oriented curriculum.

The second in-service meeting on formative tests was a presentation on technical characteristics of the five popular test modes that may be employed in developing in students problem-solving abilities. Our remaining three in-service meetings involved the faculty in an adapted workshop approach to the construction and evaluation of test items in each of the test modes.

In the third session, sample completion, true-false, and multiple choice items, prepared earlier by three members of the faculty selected for the purpose, were presented to the faculty group for analysis of their technical correctness, the clarity of their composition and the value of their content in relation to our concern.

This involvement of the faculty in the construction and evaluation of items in three test modes proved to be very effective in emphasizing how tests can develop criticalness in solving test problems.

The fourth session was devoted to a similar analysis of matching and essay test items earlier prepared by two other selected members of the faculty and used as a basis for faculty involvement in evaluating these items as formative problem-solving exercises.

These two adapted workshop sessions were followed with a summary session in which one instructor presented prepared problem-solving tasks in each of the five test modes, to demonstrate that it is not the particular test mode that determines the instructional value of a test item, but the degree to which the substance of the item involves the test taker in critical thinking and scientific problem-solving.

The test items developed for this session are models of the potential of all five test modes for involving students in critical levels of problem-solving that utilize their comprehensive scientific knowledge and skills.

A faculty must continue to evaluate and update itself against new directions and new ways and means that are the latest developments in the profession. Since problem-solving is the new emphasis in medical education generally, as well as in our own program locally, we need to overcome any teaching behavior that is in conflict with our new thrust. The outcomes of our recent in-service sessions have been encouraging in releasing various strengths among us. We will continue to utilize each of our reform components in a concerted effort to produce competent medical and clinical problem-solvers from the pool of potential veterinarians who are our total faculty responsibilities.

C. SUMMARY OF PROGRAM ANALYSIS

During the period 1975-1980 (six summer sessions), 117 trainees participated in the prematriculation program, of which 77 (66.6%) were admitted to the School of Veterinary Medicine at Tuskegee Institute. Since data on the 1980 summer trainees are incomplete, this analysis will cover the summer trainee groups 1975 through 1979.

Sixty-one of 92 trainees participating in five summer pre-entry programs (1975-1979) were selected by the Veterinary Admissions Committee to enter the first professional year based on their performances during the summer. Of those admitted, 49 (80%) were retained and 14 (23%) qualified for Tuskegee Institute's Dean's List. It is noteworthy that 23 or 38% of these trainees taking the preVAT scored at or below the 05 percentile. The 31 trainees not admitted included 8 high school seniors, one second-year student from the Institute's School of Nursing (who graduated in 1979), 4 veterinary students entering the second professional year and 18 students with two or more years of post-secondary education. (Table 4)

Trainee progress in the veterinary curriculum was monitored against baseline achievement levels accumulated at entry into the self-help program. The comparison of VAT scores taken upon admission to the School of Veterinary Medicine with those taken prior to entry in the Summer Program provided a measure of the changed behavior of the trainees. (Figure 1)

A comparison of percentile scores recorded for the pre and postVAT performances of those trainees admitted to the School of Veterinary Medicine seems to indicate that the aptitudes identified by this instrument as valid predictors of success in the study of veterinary medicine were served effectively by the skills and enrichments available in the summer program. A careful examination of the individual percentile scores in Appendices I, II, III, IV, and V reveal progressive changes not limited to the relatively strong students. It seems significant that one trainee in both 1976 and 1977 were able to increase their scores by 40 percentile points. Six trainees (three 1975, one 1977, and two 1979) increased their scores by 30 points; and nine trainees (two 1975, two 1976, three 1978 and two 1979) by 20 points. (See Appendix VII). As a result of participating in the five HCOP summer programs, twenty-one of sixty-one trainees (34.4%) admitted to the School of Veterinary Medicine increased their postVAT scores by 20 percentile points or more. The average group VAT percentile increases are less dramatic, but do show substantial increases for all years. (Appendix VIII)

The VAT appears to provide a rigorous test of the ability of the student to put various skills to work in a variety of test conditions under exacting time demands.

A further indication of the effectiveness of the summer program and the postmatriculation supportive enrichment component is the accumulative group Grade Point Average (GPA). Appendix IX shows that group grade point averages tend to improve as the trainees progress through the curriculum. These increases also indicate the extent to which interventive measures introduced to improve the learning and study process have been successful.

It was possible this year to introduce a third evaluation index as 1979 and 1980 signalled the first groups of summer trainees to complete the curriculum and graduate. However, data on the eleven (11) trainees who graduated in 1980 were not included due to incomplete collection of information.

Ten trainees, 25% of the 1979 graduating class, were awarded the Doctor of Veterinary Medicine (D.V.M.) degree; four maintained a GPA of 3.00 or better (on a 4.0 scale) during the entire professional program. Six of these summer trainees graduated with high or highest honors. This is especially significant since none of these candidates had competitive entrance GPAs or VAT scores. Examination of the records reveals that eight of the ten scored at or below the fifth percentile (four at the 05th, three at 02 and one at the 01st percentile).

Further evidence of the success of the program is revealed in the performance of the 1975 summer train-

ees on National Standardized Professional Qualification Examinations (National Veterinary Examination Board and the United States Department of Agriculture's Accreditation Examination) and their employment records. (See Table 5)

To be able to practice veterinary medicine, graduates of accredited veterinary schools must sit for two separate boards—National Board of Veterinary Medical Examiners and the specific State Board examination. In addition, the United States Department of Agriculture's Accreditation Test must be passed before a graduate veterinarian is permitted to perform tuberculosis or Brucellosis tests or prepare health certificates for interstate or international shipment of animals. Each trainee successfully passed the National Board Examination and the USDA Accreditation Test (scored at or above 75%). Nine successfully passed the respective State Board examination (one was granted a one-year temporary permit). These HCOP trainees are licensed to practice in the following states: Alabama, Georgia, Florida, Maryland, Michigan, North Carolina, Tennessee and South Dakota. All trainees are gainfully employed in some area of veterinary medicine: federal government (public health, armed forces)—4; practice—3; graduate school or internship program—3.

The above data seem to support the thesis that the prematriculation summer program followed by a carefully designed postmatriculation academic reinforcement program has been successful in preparing trainees for the rigors of the first-year and, in addition, provided the assistance needed to progress satisfactorily through the professional curriculum. The most important single criterium of any professional program is the extent to which the graduate is prepared to function as a competent professional. The initial assessment of our program is most encouraging.

D. SUMMARY OF ACCOMPLISHMENTS — 1975-1980

Since beginning our Special Health Careers Opportunity Program and continuing in our HCOP evaluations, we have constantly analyzed our strengths and weaknesses as a means of improving the program. A current assessment follows:

1. Strengths

   a. Established Program

      After five years of developing a program of learning-to-learn in which students have been encouraged to mobilize their efforts and establish vital links between learning techniques and academic course work, we can no longer be considered an experiment. Twenty-one summer trainees have graduated from the professional program. The impressive rise in the retention rate and the ability of a significant number of our target group to be ranked in the upper quartile of the class, is vivid testimony that we have identified major academic skills that are basic to coping successfully with the rigors of the veterinary medical curriculum. (See Appendices I, II, IV and V). More importantly, two groups of trainees have completed the program and are pursuing careers as professionals. (Table 5)

   b. Flexibility

      Both "in house" and standardized tests (Veterinary Aptitude Test — VAT) and other carefully chosen instruments have not been utilized to penalize students in relation to disadvantages inherent in their personal circumstances, but to appraise the thinking/study skills which have been identified as learning processes essential to success in the veterinary curriculum.

   c. Faculty

      A faculty of 16 qualified professionals and an excellent supportive staff already in place, who are committed to develop and implement interventive measures to impact on student needs, learning problems and developing inadeq-

uacies, contribute significantly to the success of this program. This, plus a closely coordinated peer and faculty tutorial staff, permits us to assume the responsibility for providing academic reinforcements and counseling during the first two professional years. A most important consideration has been the willingness of the total faculty to observe the students under "battle" conditions and to assist with whatever problems might emerge during the academic year. Our Summer Program instructional staff is a stable one. We have grown together in educational insights relative to both the typical needs of our trainees and the kinds of interventive measures that are most effective.

d. Diagnostic and Prescriptive Activity

Our success in developing a series of pre and post-testing instruments that appear to identify those skills necessary to improve learning and cognitive strategies and thereby increase the student's motivation has been established. Later followed by a well-coordinated reinforcement activity with specially designed interventive measures that extend the merits of the summer program this has enabled our faculty to prescribe and treat weaknesses in the cognitive and affective areas.

e. Test-Taking

We have sought to use test-taking as the vehicle for the development of problem solving skills. A well-constructed test item contains all of the essential elements of clinical problem solving. Test-taking techniques have become inherent parts of all our instructional activities.

f. Faculty Interest

Expressions of faculty interest have resulted in the development of a series of in-service faculty meetings during which time an opportunity is provided to share and discuss implications for improving the efficiency of the total program.

g. VAT Scores and Grade Point Averages

Significant increases in pre and postVAT scores and accumulative grade point averages are mute testimony to the value of this program.

h. Supportive Programs

Two specific supportive programs — an Autotutorial Laboratory and a developing Computer Based Education facility — deserve mention. Each facility in its own way has contributed significantly to our effort to increase the number of graduates without compromising the quality of our professional program. We have sought to increase the rate of learning and development of independent thinking and also create those materials and situations required for self-development of study attitudes and habits.

i. Minority Applicants

The number of minority applicants to the School of Veterinary Medicine at Tuskegee Institute increased from 76 during the preproject period to 180 for the class of 1979, an increase of 136.8%.

2. Weaknesses

As we follow our summer enrollees through their basic science courses, we have become aware of the existence of variables which seem to elude currently established assessing instruments. We have developed a series of pre-and post-testing instruments that appear to identify those skills necessary to improve learning strategies and that thereby increase students' motivation and adequacy. These strategies have been helpful to our faculty and tutors in their later efforts to remediate needs of students in both cognitive and affective areas. Our instruments may need to be refined further to include screeners of these more subtle learning characteristics, or our insights as diagnostic may need to be sensitized to interpret the less ob-

vious meanings of our students' test performances.

It is in this area that lies our challenge for further improvement of our program. We have a genuine concern to understand some of the irregularities in the continual performances of our students, which may explain the fact that occasional cases exceed, almost miraculously, a prediction based on early accumulated data, while others, whose scores are above the norm, progress through the program at marginal levels.

A knowledge of the existence of these irregularities between expectation and fulfillment will be helpful only to the extent that we explore for an understanding of whether the problems are academic. If so, our understanding must take the form of educational principles which may be applied by those who instruct in determining appropriate methods, teaching strategies, content sequences, and learning resources. We feel now that our weaknesses in this area can be overcome to some degree through an in-depth study of "deviant" cases—the "over-performers" and the "under-performers" — in relation to our data-based predictions.

It is our opinion that a critical evaluation of our educational plan and past accomplishments qualifies our program as being established and productive. It is our aim to continue to improve on this record in a manner that is responsive to the needs of the students we serve.

APPENDIX I

SYLLABUS
THE SURVIVAL SKILL AND SCIENCE ENRICHMENT PROGRAM
SUMMER 1980

SCHOOL OF VETERINARY MEDICINE
ROSENWALD CENTER
ROOM 316

TUSKEGEE INSTITUTE
TUSKEGEE INSTITUTE, ALABAMA 36088
APRIL 28, 1980

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PROGRAM OVERVIEW

I. Program Rationale

"The goal of veterinary medical education today should be the creation of truly scientific veterinarians. This means that each such product must have a clear knowledge and understanding of the basic and essential facts and principles underlying those academic and clinical disciplines encompassed by the term 'medical sciences' and the understanding and ability to keep himself abreast of new knowledge and developments so as to prevent obsolescense."[1]

A new Curriculum Reform Program was implemented in the School of Veterinary Medicine at Tuskegee Institute, in 1970. Two major objectives were identified as the ultimate goals of veterinary medical education: (1) essential basic scientific knowledge and understandings, integrated and synthesized into the concepts, principles, and generalizations which are fundamental to the development of clinical competencies; and (2) the inclination and ability to continue the upgrading of these professional competencies through the skillful use of available learning resources: print and nonprint media.

Supporting these two important objectives is a third that is essential: the two thinking/study skills through which a student can organize meaningfully the massive amounts of information he will encounter; and then draw from this pool of integrated knowledge those facts which are critical in clinical problem-solving.

These three objectives: (1) enriched, integrated basic science knowledge and understandings; and the subserving ones: (2) library skills and (3) survival study skills are so interrelated that they fuse into a unitary power as a student develops into an effective learner. Therefore, for convenience only, these objectives are being conceived and presented as three facets of instruction and will be directed by three special staffs, working cooperatively to develop in participants the veterinary medical aptitudes essential to survival during the first two basic years of the professional curriculum.

II. Program Goals: Veterinary Aptitudes

Five aptitudes have been identified by the veterinary medical profession as essential cognitive requisites for success in the professional curriculum. These aptitudes fall into two major divisions: (1) basic science content; and (2) learning-to-learn skills. Measures in the veterinary aptitude screening instrument include in the content areas a sampling of quantitative concepts and relationships, biological principles and concepts, and chemical concepts and problems.

In the skill area, the instrument measures reading comprehension in relation to science-oriented, textbook-style written material; and study (analytical) reading of scientific information.

All five measures provide norms, which are helpful indicators of particular inadequacies a student may have among these designated aptitudes.

The five aptitudes described above have become a vital part of the interventive design of the Tuskegee Veterinary Summer Program, which has as its primary goal to short-cut its high-risk summer participants to a point of successful articulation with the demands of the courses which they will encounter during the first professional year in the veterinary medical curriculum. Our previous experiences with high-risk veterinary students have indicated more specific deficiencies in such supportive study strategies as note-taking; note-organizing; test-taking as a problem-solving exercise; meaningful attacks on numerous unfamiliar medical terms through the skillful use of structure and context; and the responsible and effective use of auto-tutorial learning resources in the remediation of personal and course problems.

These more specific, more locally typical learning problems have been subsumed into the components of our summer program; as will be evident in a later section: Program Structure.

In summary, the broad goals of the summer program are of three types,

with major emphasis indicated in the underlined words:

1. Enriched integrated basic science data base information; and critical skills of processing this information in medical problem-solving;
2. Self-responsible use of learning resources (print and non-print media) for auto-tutorial purposes;
3. Learning-to learn skills in the complementary functions of synthesis and analysis, including the application of critical and creative techniques to the unlocking of numerous unfamiliar medical terms.

III. Baselines: Pre-Profile

To be educationally valid, an instructional program must be a developmental sequence between a known beginning point and a point conceived to be the goal. Both points must relate to common values that are identifiable in measurable terms. Since the competencies of the desired finished product must be the basis of determining instruction, the beginning point for each competency must be basic information if one is to set priorities and emphasis.

Our pre-assessment program includes instruments which will indicate the initial degrees of your achievement in relation to each of the aptitudes that constitute program goals. Each of you brings to the program some degree of adequacy in each of these aptitudes. Often this adequacy is greater than you realize. Sometimes it is less. Always there are irregularities of strengths among various essential competencies. It is important, therefore, that you have an understanding of yourself as a learner, and that you use this understanding as a basis for self-direction in improving your learning profile as the summer progresses. You should actively seek to use class and auto-tutorial instruction for maximal growth.

Since your success as a learner may be influenced by non-cognitive factors as well as cognitive ones, the pre-assessment program includes a diagnostic narrative which seeks to draw from you, biographical information that may reflect your motivations, successes, failures, confidence, self-image, ability to recognize problems, and relevant experiences with animals or veterinarians.

Facts from the personal assessment narrative often help in understanding your uniqueness, both as a person and a learner.

Results from pre-tests will be summarized in a profile for each of you. This profile will be made available on Friday of the first week (June 6) with interpretations of its implications for you as you engage in the six-week instructional period. Included among implications is the fact that the baseline in each function pre-assessed is tentative and should be raised to your maximal ability as the program progresses. This progress will be moasured continually through formative unit tests, with occasional cumulative tests that demand that you integrate, interrelate, and apply this enriched knowledge and your developing study skills.

IV. Program Structure

A. Integrated Basic Science Enrichment Facet: The Central Phase of the Summer Program

As previously stated, the major goal of the four-year curriculum of veterinary medicine is to produce a truly scientific clinician. This goal involves several abilities: (1) a knowledge of current sources of scientific information; (2) methodology in utilizing these sources to derive scientific understanding; and a mastery of those scientific thinking processes which together constitute what we know as the scientific method.

The science enrichment program will begin with the library as a major learning resource of the veterinarian in obtaining new scientific information or in the retrieval of scientific information for use in new scientific problems to be solved. The library will interphase more and more in subsequent science units, becoming the most vital element in the final science unit: a practicum in the

application of basic sciences and survival skills to the study of the cell as central to all medical sciences.

The objective of the integrated basic science facet is — to reacquaint you with the scientific method and its importance and application in the learning process, in relation to biomedical sciences.

Special emphasis will be placed on:

1. Collection of information
2. Organization of information
3. Conceptualization and functionalization of scientific facts
4. The application of the scientific method through quantitative and qualitative analysis
5. Reporting

This facet of the summer program is composed of three sections.

The first section of the basic science enrichment facet will review the nature of the scientific method, which you will utilize in greater depth and criticalness as you move into the application of integrated science information to medical problem-solving.

Three critical thinking skills are vital components of this method and will be given strong emphasis throughout the summer program: (1) interpretation or generalization; (2) judgement or critical evaluation; and (3) application or problem-solving.

The skill of interpretation is of immeasurable value to the clinician. The same factual information may be generalized or interpreted in ways to result in opposite conclusions by two individuals who have, alike, understood the particular literal facts. You will be guided in developing the skill of critically manipulating or processing facts to arrive at broader meanings that are valid syntheses that go beyond the particulars that they are accumulating.

Since interpretations are crucial in the solution of medical problems, you must also develop and utilize the skill of judgement or critical evaluation of your interpretations. This is a high-level form of critical behavior, for it involves a reexamination of the scientific facts that are the premises upon which you derived interpretations; the opening up of these interpretations to include facts newly determined through various types and levels of research; and the formulation of new synthesis or generalization.

The skill of problem-solving or transferring theory into practice involves more than an accumulation and integration of literal and interpreted scientific data. The value of scientific information is its usefulness in relation to the analysis and solution of medical and clinical problems. The summer program will include theoretical medical problems that will exercise you in the interpretation, evaluation, and application of all of the scientific information which the science facet will be reinforcing, enriching, and integrating through its three divisions: the science units; the lecture series; and the cell practicum.

The Lecture Series

The lecture series provides a functional sequence within the perspective of the summer program: (1) an overview of the total professional curriculum as a meaningful progression through the basic sciences of the first two years into clinical problem-solving; (2) an overview of the first-year curriculum as the basic structural background for an understanding of the normal conditions of animals; (3) a utilization of the understandings of normalcy in animals in identifying types and degrees of pathological deviations; and (4) the application of this broadening data base in diagnosing and resolving medical problems.

The nine lectures in the series will provide, also, skill practice in note-taking for purposes of synthesis and analysis, concurrently

with enrichment purposes; thus serving the two facets of the summer program: survival skills and integrated basic science reinforcement.

The Interdisciplinary Cell Conceptualization Practicum

The third phase of the science enrichment facet has been designed to synthesize all of the skills that constitute the components of scientific problem-solving. A practicum — the interdisciplinary conceptualization of the cell — has been developed to serve this synthesizing purpose.

This study will begin with a review of the essential characteristics of normal cell structure; will be followed by the differential characteristics of cell functions in relation to tissues, organs, systems, and the total organisms; and will terminate with typical pathological changes in structural and functional characteristics of cells which constitute the basis of preventive and clinical medicine.

This practicum should provide each of you with a variety of exercises in the interpretation and evaluation of scientific information and the independent use of the library in the application of each of the steps of the scientific method in relation to the study of the cell as a model for the study of medicine in general.

B. Subserving Facets

1 **Library Skills**

Knowledge of a subject is never adequate or complete at any given point of time. It is important to your current development and also to your continued professional development to know where to find the information you may need. This is the most lasting outcome of a formal education. In the medical profession, in which new knowledge is developing at an exponential rate and much previously accepted information is being disproved, the library as an organized center of learning resources (print and non-print) becomes the heart of the educative process.

Objective

The library facet of the summer program is designed to provide each of you with experiences which will prepare you to become an independent learner. The design includes three objectives:

1. A knowledge of the existing types of learning resources
2. A knowledge of the problems that each type of learning resource helps solve
3. A knowledge of when and how to use these resources.

The first objective seeks to familiarize you with existing library resources that are the medical scientist's most basic tools. These tools will be utilized during later assignments.

Learning resources differ in the various purposes they are organized to serve, and should be understood in relation to these purposes. This understanding and the development of effectiveness in applying this understanding in the selection and versatile utilization of instructional resources will constitute the major activities of the second and third objectives of the library facet.

During the last phase of the integrated science enrichment facet the library staff and science staff will share a practicum dealing with the cell as an integration of all basic sciences and requiring each of you to use your library/study skills in solving the problems raised in each assignment.

2. **Survival-Skills Facet:** Skills of organization and analysis of scientific terminology and facts.

Three study skills have been identified as crucial to survival in the veterinary medicine curriculum: (1) medical vocabulary-building skills; (2) organizational skill and (3) dis-

criminative or analytical problem-solving.

Unit 1 — Medical — Vocabulary —Development — Skill

Basic to all learning-to-learn skills is the ability to unlock the meanings of the numerous terms which are the elements of the information which must be gained through oral and written communication. The terms are too numerous to be learned through rotod, fragmented processes; or in forms that are so fixed that they cannot be utilized flexibly as your understandings broaden and integrate into scientific concepts.

Three dynamic sub-skills that constitute a meaningful attack on medical terms are (1) structural analysis (2) contextual analysis; and (3) conceptualization through the technique of analogy.

Structural analysis is a process which utilizes meaningful medical word parts (prefixes, roots, and suffixes) in deriving the meanings of unfamiliar words and in constructing new words to express rapidly developing scientific concepts. Through this skill you will develop facility in coping with numerous words constructed from familiar word parts in a great variety of combinations.

As you begin to develop facility in the comprehensive use of structural analysis in attacking the meanings of medical terms, you will discover the diverse potential of every medical term in different contexts. Here, you will confront the fluidity of an important scientific term in relation to the substance, style or purpose of a particular context.

Practice in the use of contextual clues, therefore, will provide experiences that serve to develop your readiness and mobility of responsiveness to the problematic nature of vocabulary and concept development as a critical and creative thinking process. The use of contextual and analogous clues in discriminative comprehension of words and concepts parallels Unit III of the survival skills program (test-taking or problem-solving).

The medical terminology text is a self-instructional program composed of ten units. As you progress through the ten-unit sequences, you will be programed into an extensive and reinforced vocabulary of important medical terms.

Unit 2 — The Organizational Study Skill

Note-taking is not only a basic aspect of both survival thinking skills: organization and problem-solving, but also is an essential function in the science enrichment and auto-tutorial aspects of the summer program. The note-taking skill is therefore the primary unit for the entire summer program.

Unit II stresses the importance of the major sub-skills of effective note-taking for comprehensive understanding: (1) the survey of information to be comprehended through such survey clues as table of contents, introductory chapter or preface, chapter title, topical headings and introductory or/and summary chapter; and (2) the formulation of main-idea questions that activate and direct the reader or listener toward general understandings or conclusions that are useful in summarizing or outlining information, and discerning a structure within which more specify questions may be raised and, subseuqnetly, inter-relationships of ideas established. Actually surveying and general questioning are vital coordinates of the comprehension and organization of the masses of information that will be required in the basic sciences of veterinary medicine.

Unit 3 — Analytical or Problem-solving Study Skill

Unit III utilizes note-taking in the more discriminative handling of information for problem-solving or test-taking purposes. In this unit, the shift of emphasis is toward two powers. First, you must develop the skill of question-raising as purpose-setting in critical reading for specific answers.

Second in problem-solving or test-taking, you must develop the

power to respond adequately and accurately to the conditions of the question that directs your search.

The practice exercises for the basic study-skill units — note-taking, note organization, and note utilization, will include print and non-print instructional media: films, cassettes, texts, live lectures by instructors or first-year courses, video tapes, printed articles and on-going lectures from the units of the science enrichment program.

During the last three weeks of the program, you should be ready for self-direction in the utilization of your enriched knowledge and skills in relation to a practicum: The study of the cell. As this practicum integrates and functionalizes the aptitudes undertaken in the three summer facets, you will discover that the various objectives undertaken do not operate fragmentarily, and that the major goal of the profession will continue to bring your various aptitudes into a functioning synthesis.

V. Post-Assessment

The summer program goals have been stated earlier as important veterinary aptitudes which were assumed by the faculty of the three program facets as their specific objectives. Early measures of your initial aptitudes were profiled to indicate irregularities among your essential developments and to establish for each aptitude a baseline from which you should make progressive changes.

Since students have different learning styles and paces, problems in appraising growth are inevitable. Nevertheless, as the program progresses, evidences of learning changes should begin to surface. These evidences should reflect themselves in your post-tests, which will be given during the last week of the summer session, in which each of the functions assessed in the pre-tests will be reassessed.

The growth which you achieve during the summer should be reflected in the degree of change shown in a comparison of the pre-profile and the post-profile. However, it is important to note that short-term evaluations are not accurate measures of the presence of change or of the lasting quality of change.

The summer faculty is concerned that the achievements of the summer will be reflected in your survival during the first basic science year; for the primary goal of the summer program is to develop those aptitudes crucial to survival in the veterinary medical program. Beyond the summer the indices for evaluating program effectiveness will be — Grade Point Averages (GPA) and the eventual graduation from the professional program.

Those of you who need further reinforcement in crucial learning aptitudes are strongly urged to participate in the tutorial program, which is an extension of the summer reinforcement activity.

PLATO (Programmed Logic of Automated Teaching Operations) is a recent addition to our systems approach to initiate learning-to-learn techniques. You will be introduced to the PLATO system's dynamic and intensive computer based individual instruction which allows for greater freedom in learning. Immediate feedback and self pacing is provided so that you are able to move at your own pace.

Introduction to the system will occur early in your training period.

1980 Program Schedule — June 2 through July 25

Daily Classes will begin promptly Monday through Friday — Rosenwald Center, Room 316
8:30 a.m. - 11:30 a.m.
1:30 p.m. - 3:00 p.m.

1ST WEEK, JUNE 2-6

Monday, June 2

8:30 a.m. An Overview of the Professional Curriculum and the Summer Program Goals, Sequence and Demands (Dr. E. W. Adams)
10:00 a.m. Personal Factors that Affect Student Performance (Dr. T. S. Williams)
11:00 a.m. "You Can Surpass Yourself" (Film)
1:30 p.m. Instructional Tour of the Library: Print Resources (Mrs. Ford)

Tuesday, June 3

8:30 a.m. Reading test (Mrs. Henderson)
10:00 a.m. Introduction to Survival Skills (Mrs. Henderson)
1:30 p.m. Instructional tour of non-print library resources: AT/AV lab and Computer center (Dr. Johnson and Dr. Webster

Wednesday, June 4

8:30 a.m. Vocabulary test (Dr. Judkins and Mrs. Henderson)
10:00 a.m. Note-taking as a System (Mrs. Henderson)
1:30 p.m. Instructional tour of the clinic (Dr. E. W. Adams)

Thursday, June 5

8:30 a.m. Taking notes from lectures (Mrs. Henderson)
10:00 a.m. Introduction to Science Enrichment Facet (Dr. E. W. Adams)
1:30 p.m. Profile analyses (Mrs. Poole)

Friday, June 6

8:30 a.m. Medical Terminology Skills (Dr. Judkins)
10:00 a.m. Nature of Scientific Method: An Introduction (Dr. Watson)
1:30 p.m. Film: "Because We Care"

2ND WEEK, JUNE 9-13

Monday, June 9

8:30 a.m. Lecture: An Overview of the First-Year Curriculum as Background for Understanding Structural Normalcy in Animals (Dr. R. C. Williams)
10:00 a.m. Producing scientific information (Dr. Watson)
1:30 p.m. Organization of Scientific Information: Bibliographic Ladder (Mrs. Ford).

Tuesday, June 10

8:30 a.m. Discussion of Monday's note-taking practicum and an analysis of the organizational skill to be applied to lecture on Wednesday (Mrs. Henderson)
10:00 a.m. Obtaining and evaluating scientific information: a step in the scientific method (Dr. Watson)
1:30 p.m. Assignment of library practicum topics and analysis of expectations in relation to presentations (Dr. Watson)

Wednesday, June 11

8:30 a.m. Lecture: The Scientific Approach to Clinical Medicine: the Significance of the Basic Science Curriculum to Medical and Clinical Problem-Solving (Dr. C. L. Padmore and Mrs. Ford)
10:00 a.m. Paradigm (Dr. Watson)
1:30 p.m. Related library assignments for practicum presentations (Mrs. Ford)

Thursday, June 12

8:30 a.m. Continuation of organizational skill practice (Mrs. Henderson)
10:00 a.m. Hypothesizing: A step in the scientific method (Dr. Watson)
1:30 p.m. Library practicum assignments (Mrs. Ford)

Friday, June 13

8:30 a.m. Medical Terminology Skills (Dr. Judkins)
10:00 a.m. Student presentations (Dr. Watson and Mrs. Ford)

1:30 p.m. Student presentations (Dr. Watson and Mrs. Ford)

3RD WEEK, JUNE 16-20

Monday, June 16

8:30 a.m. Test-taking as a system (Mrs. Henderson)
10:00 a.m. Practicum presentations (Dr. Watson)
1:30 p.m. Evaluation of presentations (Dr. Watson)

Tuesday, June 17

8:30 a.m. Lecture: The Role of Pathology in Veterinary Medicine (Dr. Dade); Related survival skill activity (Mrs. Henderson)
10:00 a.m. Introduction to qualitative and quantitative systems of presenting scientific information (Dr. Webster)
1:30 p.m. Practicum on qualitative presentation of scientific information (Drs. Webster and Johnson)

Wednesday, June 18

8:30 a.m. Test-taking continued (Mrs. Henderson)
10:00 a.m. Qualitative presentation of scientific information continued (Dr. Webster)
1:30 p.m. Related evaluation of qualitative presentation of scientific information (Dr. Webster)

Thursday, June 19

8:30 a.m. Lecture: Significance of Poisonous Plants in Relation to Veterinary Medicine (Dr. Judkins)
10:00 a.m. Quantitation in the scientific methods (Dr. Webster)
1:30 p.m. AV/AT Support of quantitation lesson (Dr. Webster)
2:30 p.m. Survival skill support (Mrs. Henderson)

Friday, June 20

8:30 a.m. Medical terminology (Dr. Judkins)
10:00 a.m. Discussion of quantitation activities (Dr. Webster)
1:30 p.m. Selected media on quantitation (Dr. Webster)

4TH WEEK, JUNE 23-27

Monday, June 23

8:30 a.m. Reinforcement of multi-purpose in note-taking, organization, and test-taking (Mrs. Henderson)
10:00 a.m. Data interpretation
1:30 p.m. Related practicum on data interpretation

Tuesday, June 24

8:30 a.m. Lecture: Examination and Diagnostic Procedures in Small Animal Medicine (Dr. Jeffers)
10:00 a.m. Data interpretation continued
1:30 p.m. Evaluation of preceding practicum on data interpretation (Dr. Webster)

Wednesday, June 25

8:30 a.m. Lecture: Problem-oriented Veterinary Medical Records System of Learning (Dr. Hall)
10:30 a.m. Conclusion of quantitation of scientific information
1:30 p.m. Practicum activity

Thursday, June 26

8:30 a.m. Cumulative review of the synthesized study systems: note-taking, organization, and test-taking (Mrs. Henderson)
10:00 a.m. Summary of science enrichment, Unit I (Dr. Watson)
1:30 p.m. Cumulative review of Unit I: an analysis of a research project (Dr. E. W. Adams)

Friday, June 27

8:30 a.m. Medical terminology cumulative review (Dr. Judkins)
10:00 a.m. Introduction to the cell practicum (Dr. E. W. Adams)
1:30 p.m. AT/AV presentation on the cell — An interdisciplinary study of the cell — The Central Element of All Life

PART II Cell Conceptualization, June 30-July 18

5TH WEEK, JUNE 30-JULY 4

Monday, June 30

8:30 a.m.- A. Basic Nature of Cell structure (Dr. Chibuzo)

11:30 a.m. B. Survival skills — related activities (Mrs. Henderson)
1:30 p.m. Library-related activities

Tuesday, July 1

8:30 a.m.- A. Cell structure continued
11:30 a.m. Survival skills — related activities (Mrs. Henderson)
1:30 p.m. Library-related activities

Wednesday, July 2

8:30 a.m.- A. Cell structure continued
11:30 a.m. B. Survival skills - related activities (Mrs. Henderson)
1:30 p.m. Practicum (Dr. Chibuzo)

Thursday, July 3

8:30 a.m.- Summary of cell structure
11:30 a.m. (Dr. Chibuzo)
1:30 p.m. Library-related activities

Friday, July 4 — Holiday

6TH WEEK, JULY 7-11

Monday, July 7

8:30 a.m. - A. Cell function (Dr. Verma)
11:30 a.m. B. Survival skills activities (Dr. Judkins and Mrs. Henderson)
1:30 p.m. Library-related activities

Tuesday, July 8

8:30 a.m. A. Cell function continued (Dr.
11:30 a.m. Verma)
1:30 p.m. Library-related activities

Wednesday, July 9

8:30 a.m.- A. Cell function continued (Dr.
11:30 a.m. Verma)
B. Survival skills-related activities
1:30 p.m. Library-related activities

Thursday, July 10

8:30 a.m.- Summary activities on cell
11:30 a.m. function (Dr. Verma)
1:30 p.m. Concluding practicum

Friday, July 11

8:30 a.m.- A. Pathology of the Cell (Dr.
11:30 a.m. Dade)
B. Survival skills-related activities (Mrs. Henderson)
1:30 p.m. Library-related activities

7TH WEEK, JULY 14-18

Monday, July 14

8:30 a.m.- A. Pathology of Cell continued
11:30 a.m. (Dr. Dade);
B. Survival skills related activities (Mrs. Henderson)
1:30 p.m. Library-related activities or clinic tour

Tuesday, July 15

8:30 a.m.- Summary activities on cell
11:30 a.m. pathology (Dr. Dade)
1:30 p.m. Clinic activity

Wednesday, July 16

8:30 a.m.- A. Cell Transformation and
11:30 a.m. Immunology (Dr. Lam)
B. Survival skills-related activities (Mrs. Henderson and Dr. Judkins)
1:30 p.m. Library-related activities

Thursday, July 17

8:30 a.m.- Cell Transformation and
11:30 a.m. Immunology continued
1:30 p.m. Library-related activities

Friday, July 18

8:30 a.m.- Summary of unit on cell
11:30 a.m. transformation and immunology
1:30 p.m. Summary practicum

8TH WEEK, JULY 21-25

Monday, July 21

8:30 a.m.- A. Conclusion of cell practi-
11:30 a.m. cum with emphasis on the interdisciplinary conceptualization process as a composite of medical contents and critical thinking systems, and as a model for the long-term study of veterinary medicine (Dr. E. W. Adams).
B. Summary testament of the support systems as tools for survival and self-continuing professional competence beyond graduation
1:30 p.m. Post-test: organization and analytical study skills

Tuesday, July 22

8:30 a.m.- Post-tests: medical termi-
11:30 a.m. nology and science units
1:30 p.m. Post-test: cell practicum

Wednesday, July 23

Post-test profiles and progress tables

Thursday, July 24

Program evaluation by participants
Program evaluation by staff

Friday, July 25

8:30 a.m. Summary and Projections (Dr. E. W. Adams)
10:00 a.m. Social hour (culmination)

APPENDIX II
PERFORMANCE OF 1975 SUMMER TRAINEES

	AVERAGE PERCENTILE SCORE		ACCUMULATIVE GRADE POINT AVERAGES			
STUDENT	June VAT	Sept. VAT	1st Year 1975-76	2nd Year 1976-77	3rd Year 1977-78	4th Year 1978-79
1	65	85	3.42	3.10	3.21	3.26
2	40	70	3.64	3.53	3.54	3.65
3	10	40	3.24	3.10	3.15	3.22
4	10	30	2.83	2.86	2.99	3.06
5	05	10	2.50	2.48	2.55	2.64
6	05	not taken	2.21	2.13	2.50	2.69
7	05	02	2.18	2.25	2.57	2.74
8	05	35	2.07	2.03	2.31	2.44
9	02	05	1.97*	1.91*	*	*
10	02	02	1.72	2.00	2.38	2.52
11	01	15	2.10	2.08	2.34	2.49
12	01	01	1.38	*	*	*

* Dropped

APPENDIX III
PERFORMANCE OF 1976 SUMMER TRAINEES

	AVERAGE PERCENTILE SCORE		ACCUMULATIVE GRADE POINT AVERAGES			
STUDENT	June VAT	Sept. VAT	1st Year 1976-77	2nd Year 1977-78	3rd Year 1978-79	4th Year 1979-80
1	99	99	3.24	3.30	3.25	3.30
2	60	85	3.00	2.98	2.91	2.90
3	50	55	3.46	3.52	3.56	3.63
4	45	85	2.93	2.94	3.02	3.01
5	40	10	3.24	3.13	3.09	2.98
6	25	45	3.24	3.28	3.46	3.56
7	10	10	2.00	2.26	2.44	2.62
8	02	02	1.55*	*	*	*
9	02	05	2.41	2.50	2.78	2.83
10	02	02	2.31	2.45	2.52	2.51
11	02	02	3.07	3.03	3.05	3.09
12	02	15	2.20	2.33	2.52	2.61
13	01	05	1.09	*	*	*
14	01	01	2.28**	2.11**	2.40**	

* Dropped
** Irregular Student

APPENDIX IV
PERFORMANCE OF 1977 SUMMER TRAINEES

	AVERAGE PERCENTILE SCORE		ACCUMULATIVE GRADE POINT AVERAGES		
STUDENT	June VAT	Sept. VAT	1st Year 1977-78	2nd Year 1978-79	3rd Year 1979-80
1	50	75	3.28	3.20	3.31
2	30	25	2.88	2.79	2.99
3	25	30	2.10	2.11	2.12
4	25	55	2.00	2.19	2.35
5	15	20	2.54	2.38	2.44
6	15	20	2.17	2.27	2.41
7	10	15	3.38	3.27	3.28
8	05	15	1.78	*	*
9	05	05	2.88	2.56	2.88

* Dropped

APPENDIX V
PERFORMANCE OF 1978 SUMMER TRAINEES

	AVERAGE PERCENTILE SCORE		ACCUMULATIVE GRADE POINT AVERAGES	
STUDENT	June VAT	Sept. VAT	1st Year 1978-79	2nd Year 1979-80
1	30	50	2.04	1.93*
2	20	40	2.65	2.21
3	20	45	2.27	2.34
4	05	25	3.90	2.61
5	05	10	2.50	2.26
6	05	05	3.23	2.77
7	02	05	2.52	2.38
8	02	02	2.12	1.83*
9	01	05	2.90	2.79
10	01	01	2.27	2.34
11	01	02	2.35	2.16
12	01	01	1.83	1.67*

* Dropped

APPENDIX VI

Performance of Students From 1979 Summer Program Admitted to First Year Veterinary Medicine Program

	Pre VAT	Post VAT	GPA (First Year)
1.	50	45	3.07
2.	25	55	2.08
3.	20	55	2.20
4.	15	35	2.64
5.	10	55	3.31
6.	10**	35	3.08
7.	05	15	2.12
8.	05**	05	2.24
9.	02	05	2.73
10.	02	20	2.10
11.	02	05	Dropped
12.	01	05	Withdrew
13.**	01	05	Dropped
14.**	01	05	Dropped

** 1978 Summer Trainees

PERTINENT DATA

12/19 = 63.1 Percent Admitted to Program

Greatest Individual Increases in Percentile Scores

45 points (1)
35 points (1)
30 points (2)

Average Percentile Increase for Group
14.8 Percentile Points

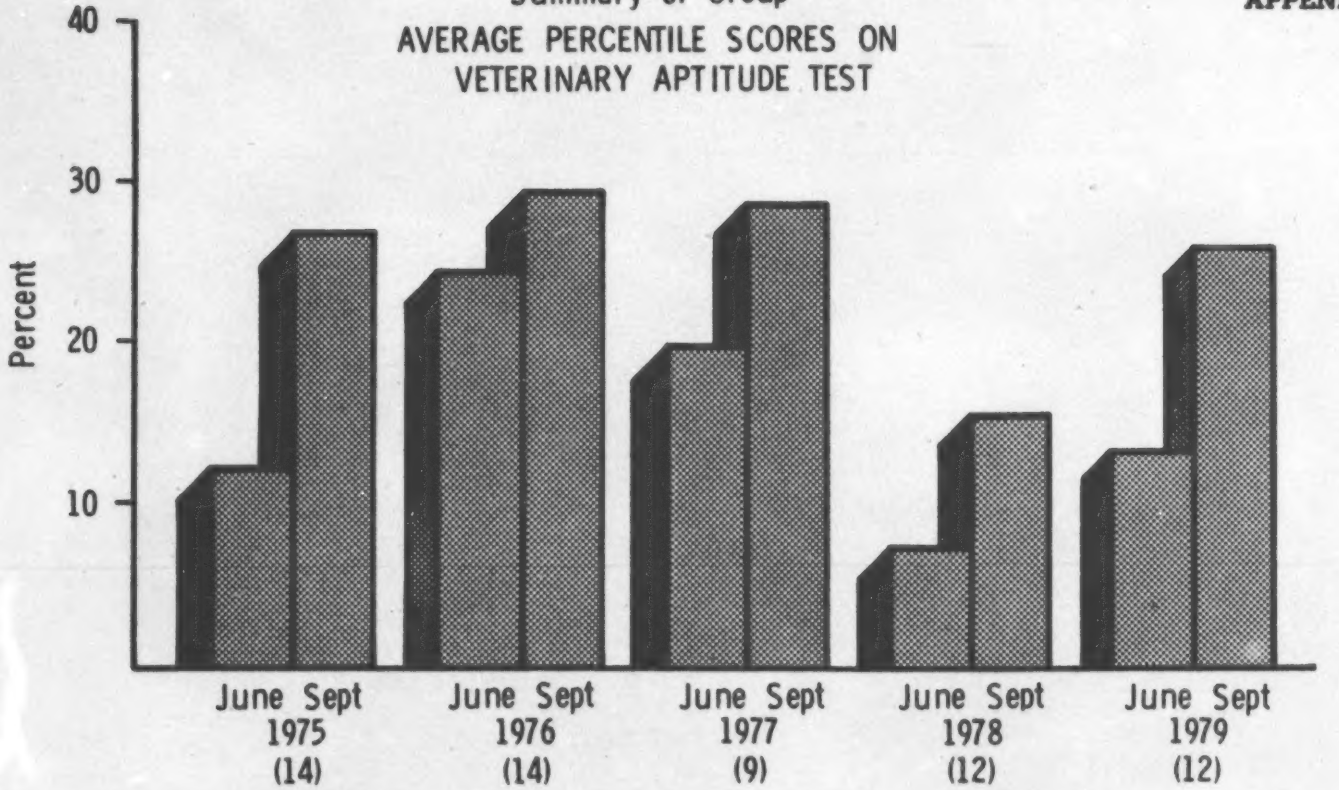
APPENDIX VII

Year	Individual Scores Increased by	Group Score Average Increase
1975	3 - 20 points 2 - 20 points	13.3*
1976	1 - 40 points 1 - 30 points 1 - 25 points 2 - 20 points	5.7*
1977	1 - 30 points 1 - 25 points	9.3*
1978	1 - 25 points 3 - 20 points	8.1*
1979	1 - 45 points 1 - 35 points 1 - 30 points 2 - 20 points 21 trainees	14.8*

* Percentile points

Summary of Group

AVERAGE PERCENTILE SCORES ON
VETERINARY APTITUDE TEST



VAT Categories Covered

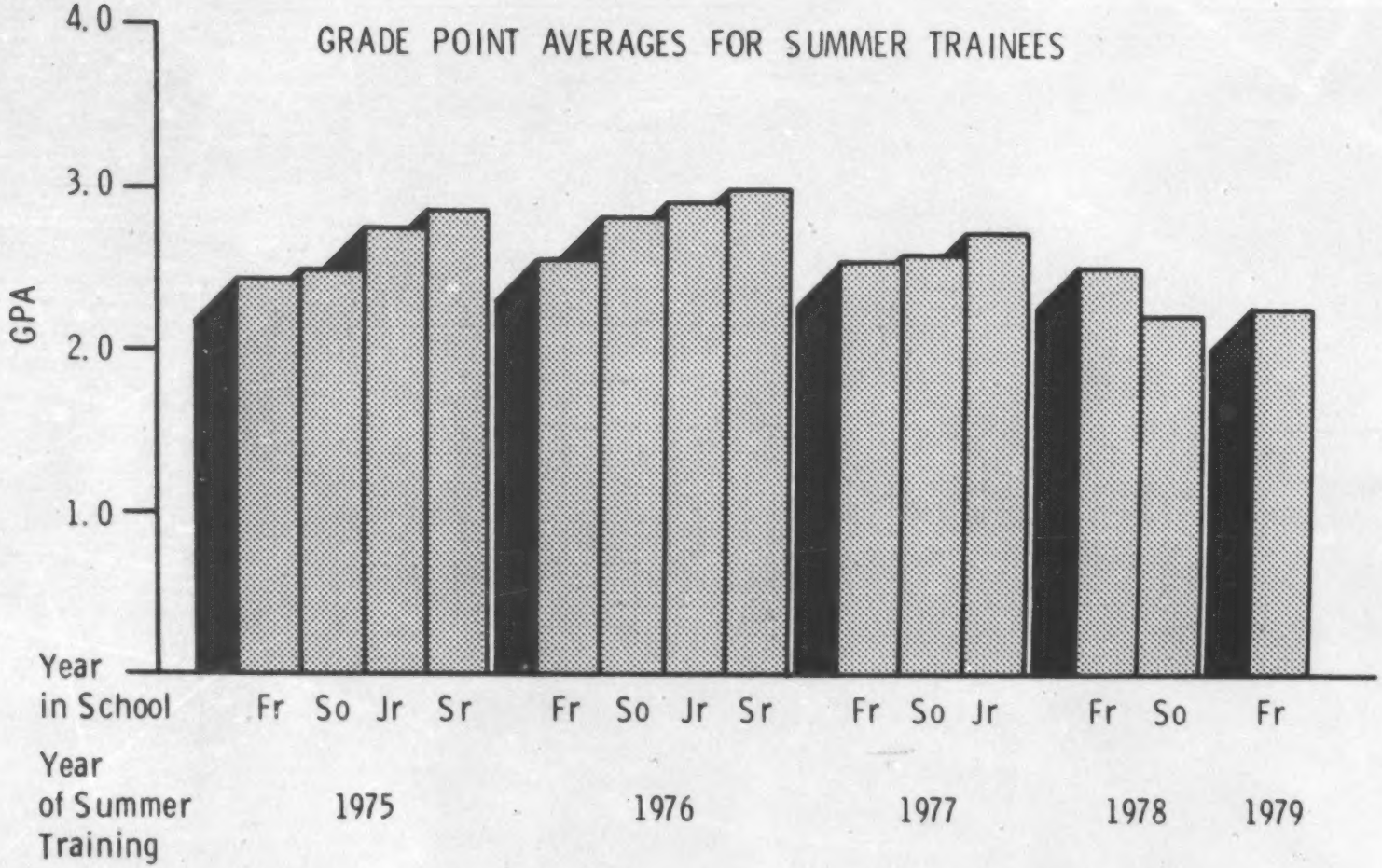
Reading Comprehension

Science- Chemistry
Biology

Verbal Memory

Quantitative Ability

APPENDIX IX


GRADE POINT AVERAGES FOR SUMMER TRAINEES
4.0
3.0
2.0
1.0
GPA
Year in School
Fr So Jr Sr Fr So Jr Sr Fr So Jr Fr So Fr
Year of Summer Training
1975
1976
1977
1978
1979

APPENDIX X

SAMPLE PROBLEM-SOLVING TEST ITEMS IN EACH OF THE FIVE TEST MODES

Constructed by Dr. Gregory Chibuzo

True & False

A young dog eight weeks old was brought into the clinic with the following symptoms: depression with sunset eyes (ventrolateral strabismus), constricted left pupil, domeshaped head but no ocular discharge. In order to diagnose this case properly, you should be able to answer the following true and false questions about the implications of the above symptoms. Write "T" for true statements and "F" for false statements in the following four blank spaces.

1. ____ If there was a space occupying lesion that completely blocked the mesencephalic aquaduct, a jugular compression maneuver would produce increased CSF pressure at the crebellomedullary cistern of this dog.
2. ____ If pupillary light response was absent bilaterally in this dog, it meant that visual cortex was damaged bilaterally.
3. ____ The ventrolateral (sunset eyes) strabismus could be explained by presence of hydrocephalus.
4. ____ The observed constricted left pupil was not due to hydrocephalic intracranial pressure on the parasympathetic nucleus of oculomotor.

Multiple Choice

The next four multiple choice questions will depend on the following history. A dog came into the clinic with the chief complaint that it became paraplegic after jumping from a height. Your examination of the dog will make you come to the following certain decisions:

1. The absence of patella reflex bilaterally indicates:
   a. Upper motor neuron deficit
   b. Lower motor neuron deficit
   c. Interruption of corticospinal tract
   d. Involvement of spinal cord segments $T_1 - T_2$
2. The thoracic limbs of the same dog were normal; its perineal reflexes were intact; it could control its urine and its anus was not dilated. Therefore you localized the lesion at:
   a. S_1 - S_3 spinal cord segments
   b. L_4 - L_7 spinal cord segments
   c. T_3 - L_3 spinal cord segments
   d. T_1 - S_2 spinal cord segments
3. Two days later you observed that the dog had bilateral Horner's syndrome which was not present the day before and that it had become tetraplegic. The perineal reflex was still intact and the anus was closed. Then you concluded that there was:
   a. An ascending myelomalacia
   b. A descending myelomalacia
   c. C_8 - T_2 spinal cord segments are normal
   d C_1 - C_7 spinal segments are normal
4. The animal died primarily because of:
   a. Uppermotor neuron deficit
   b. Myelomalacia present at T_1 - T_2
   c. Respiratory failure
   d. paraplegia

Matching Questions

In the following four questions, match the items listed in Column B with the items listed in Column A by placing the letters preceding the items in B in the most appropriate blank spaces preceding items in A as requested in each question. There may not be a one-to-one correspondence always.

1. A dog was brought into the clinic with the chief complaint that it had lost the use of its voice. On physical examination the clinician further observed that the animal could not open its mouth unaided. The left half of the tongue was flaccid, the left ear was not erect while the right ear was. The left side of the face was analygesic and lost its tone. Match the symptoms with corresponding nerves that were involved:

Column A	Column B
____ CN V	a. Loss of voice
____ CN XII	b. Difficulty in opening mouth
____ CN VII	c. Flacid tongue

___ CN IX

d. Hanging left ear
e. Analgesic left half of face

2. The structures listed in Column A subserve the functions listed in Column B. Match the functions with the correct structures.

Column A	Column B
___Lateral geniculate body	a. Proprioception
___Medical lemniscus	b. Vision

Column A	Column B
___Trapezoid body	c. Hearing
___Lateral spinothalamic tract	d. Pain
___Vestibular pathway	e. Light touch and pressure
	f. Equilibrum

3. The muscles listed in Column A have their insertions on the bony prominences listed in Colum B. Match the insertions with the corresponding muscles.

Column A	Column B
___Stomach	a. Odontoblast
___Tooth germ	b. Chief cells
___Thyroid	c. Basket cells
___Cerebellum	d. Parafollicular or C cell
___Intestine	e. Paneath cell
___Cerebrum	f. Pyramidal cell

Completion

In the blank spaces provide the missing word(s).

1. A dog was brought into the clinic with lateral curvature of the vetebral column known as . The digits, tarsus and carpus of all the limbs were ridigly flexed and this condition, _____ , prevented the animal from using its limbs. On post mortem examination, it was found that the central canal of the spinal cord was dilated, a condition known as _____. There were also cavities in the white matter known as _____ The grey matter fused in the median plane and this is known as _____. It was also found that the CSF and spinal cord tissue were present in a bag of meninges that was just under the skin in the sacral region. The CSF-menigese-spinal cord tissue sac formed is called _____ and the defect in the bone of the sacrum is called _____ _____.

Essay

Show your comparative knowledge about hydrocephalus and hydrancephally below according to the limitations imposed by the following statements. You **must** limit your responses to the spaces provided. **Write BOLDLY!!**

1. Time of Occurence:
   a. Hydrocephalus
   _____
   b. Hydrancephaly
   _____
   _____
2. The degree of involvement of cortical white matter layers:
   a. Hydrocephalus
   _____
   b. Hydrancephaly
   _____
   _____
3. Blue tongue virus etiology:
   a. Hydrocephalus or hydrancephaly?
   _____
   _____
   b. When and how?
   _____
   _____
   c. Symptoms and in what animals?
   _____
   _____
   _____